STUDIES ON NEMATODES OF THE ORDER MONONCHIDA

ABSTRACT

Thesis submitted to the
Aligarh Muslim University Aligarh
for the award of the degree
OF
DOCTOR OF PHILOSOPHY
IN
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ABSTRACT

The present work deals with the morphology and taxonomy of the nematodes of the Order Mononchida Jairajpuri, 1969. An outline classification of the group, diagnoses of taxa up to subfamily and a key up to genera of Mononchida has been given. An attempt has been made to provide information about the locations of oesophageal gland nuclei and their orifices in 18 species of mononchs. In all 41 species of the suborder Mononchina and Mononchulus nodicaudatus belonging to the suborder Bathyodontina have been described from specimens collected in India, El Salvador, The Netherlands, Poland etc. Of these, 17 species are new to science, and three of the known species are first records from India. The genus Cobbonchus which is represented by a new species is reported for the first time from India. All these species belong to 10 known and two new genera, five subfamilies, six families, and three superfamilies of Mononchida. The intra-specific variations of two closely related species, viz., Mononchus truncatus and M. aquaticus have been studied in detail based on material from several localities. Identification keys to the species of the genera Mylonchulus and Iotonchus have been provided.

I. The Suborders:

1. Mononchina
2. Bathyodontina

II. The Superfamilies:

1. Mononchoidea
2. Anatonchoidea
3. Mononchuloidea

III. The families:

1. Mononchidae
2. Mylonchulidae
3. Cobbonchidae
4. Anatonchidae
5. Iotonchidae
6. Mononchulidae

IV. The subfamilies:

1. Mononchinae
2. Prionchulinae
3. Mylonchulinae
4. Anatonchinae
5. Miconchinae

V. The known genera:

1. Mononchus
2. Prionchulus
3. Clarkus
4. Mylonchulus
5. Cobbonchus
6. Anatonchus
7. Miconchus
8. Iotonchus
9. Hadronchus
10. Mononchulus

VI. The new genera:

1. Actus
2. Paracrassibucca

VII. Identification keys:

1. Key to Order Mononchida up to genera
2. Key to species of Mylonchulus
3. Key to species of Iotonchus

VIII. The known species:

1. Mononchus truncatus
2. Mononchus aquaticus
3. Mononchus niddensis
4. Clarkus papillatus
5. Clarkus propapillatus
6. Clarkus sheri
7. Prionchulus muscorum
8. Prionchulus longus
9. Mylonchulus striatus
10. Mylonchulus agriculturae
11. Mylonchulus brachyuris
12. Mylonchulus incurvus
13. Mylonchulus index
14. Mylonchulus mulveyi
15. Mylonchulus lacustris
16. Mylonchulus nainitalensis
17. Mylonchulus hawaiiensis
18. Miconchus thornei
19. Miconchus pararapax
20. Iotonchus trichurus
21. Iotonchus antedontus
22. Iotonchus indicus
23. Iotonchus parabasidontus
24. Hadronchus shakili
25. Mononchulus nodicaudatus

IX. The new species:

1. Actus salvadoricus
2. Mylonchulus clavatus
3. Mylonchulus jamili
4. Mylonchulus aquaticus
5. Mylonchulus andrassyi
6. Mylonchulus modestus
7. Mylonchulus kherai
8. Cobbonchus parabulbosus
9. Anatonchus adami
10. Anatonchus nadiri

11. Miconchus novus
12. Paracrassibucca jenseni
13. Iotonchus mulveyi
14. Iotonchus coomansi
15. Iotonchus paraantedontus
16. Iotonchus mashhoodi
17. Iotonchus longicaudatus

X. The new combination:

1. Actus minutus

XI. First records from India

Genus - Cobbonchus

Species - Iotonchus antedontus

Iotonchus parabasidontus

Mononchulus nodicaudatus

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SUPERVISOR:

This is to certify that the entire research work presented in the thesis entitled " Studies on Nematodes of the Order Mononchida " by Mrs. Samer Zehra Baqri is original and was carried out under my supervision. I have allowed her to submit it to the Aligarh Muslim University for the fulfilment of the requirements for the Degree of Doctor of Philosophy in Zoology.

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INTRODUCTION

Nematodes are found almost in every kind of habitat and constitute one of the most dominant and important groups of animals. The nematode parasites of animals were mentioned in early Egyptian records dating 4,500 B.C., but the plant and soil-inhabiting nematodes were not known until the first half of the 18th century. The latter group of nematodes may further be divided into three groups, viz., parasitic, saprophagous and predacious. The nematodes of the order Mononchida Jairajpuri, 1969 which form the subject of the present thesis, and a few other groups are known to be predatory.

The mononchs are easily recognised under low magnification because of their strongly sclerotized buccal cavity. They inhabit soil and fresh water and predate upon protozoans, rotifers, small oligochaets and soil and plant parasitic nematodes. Occasionally, they may resort to cannibalism. Steiner and Heinly (1922) were the first to observe that a single specimen of Mononchus papillatus Bastian, 1865 killed 1332 nematodes in a period of 12 weeks. Thorne (1927) concluded that M. papillatus may help in the control of sugar-beet nematode, Heterodera schachtii Schmidt, 1871. Cassidy (1931) and other workers have also reported that the mononchs feed on phytophagous nematodes. Since they destroy the phytoparasitic nematodes which are harmful to our agricultural crops,

they are of interest to nematologists. The control of plant-parasitic nematodes is the ultimate aim of all the research work that is being done on nematodes. Keeping in view the role of mononchs as potential agents in the biological control of nematodes, the present work was initiated to obtain information on the distribution and identification of these animals which is likely to be useful in future research projects.

Dujardin (1845) was the first to describe three species of mononchs from fresh water, such as Oncholaimus muscorum, Oncholaimus fovearum and Enoplus crassiusculus. Bastian (1865) proposed the first genus of mononchs to accommodate the above three species of Dujradin and also added five more species, viz., M. truncatus, M. papillatus, M. macrostoma, M. tunbridgensis and M. cristatus. Cobb (1916) proposed five subgenera under Mononchus, viz., Mononchus, Prionchulus, Mylonchulus, Iotonchus and Anatonchus. In 1917, he published an excellant monograph on the morphology, biology and systematics of mononchs. Chitwood (1939) proposed the family Mononchidae under superfamily Tripyloidea, suborder Enoplina, order Enoplida. De Man (1876), Wu and Hoeppli (1929), De Coninck (1939), Altherr (1950, '53), Pennak (1953), Andrassy (1958), Clark (1960-63) Mulvey (1961-67), Mulvey & Jenson (1967), Jenson & Mulvey (1968), Coetzee (1965-68), Jairajpuri (1969-71), Kirjanova and Krall (1969),

Coomans and Loof (1970) and a few other workers added new species, proposed higher taxa and thereby contributed much to the basic knowledge of mononchs.

The research on mononchs in Idia started rather late. Karnan (1960 & 1961a,b,c) reported a few species from South India, but the descriptions and illustrations given by him were totally inadequate, and it is impossible to identify any species on the basis of these data. The work on the taxonomy and distribution of mononchs in a systematic way was first initiated by Jairajpuri (1969). Ali and Farooqui (1970), and Jairajpuri and Khan (1975) have also contributed to our knowledge of mononchs of India.

The present work provides an account of the morphology, taxonomy and diagnostic features of the various groups of the Order Mononchida. An attempt has been made to provide information on the locations of oesophageal gland nuclei and their orifices in some species. The present work includes descriptions of two new genera, i.e., Actus under the family Mononchidae and Paracrassibucca under Anatonchidae; and seventeen new species belonging to the following genera: Actus, Mylonchulus, Cobbonchus, Anatonchus, Miconchus, Paracrassibucca and Iotonchus. Besides, twenty five known species belonging to the families Mononchidae, Mylonchulidae, Anatonchidae, Iotonchidae and Mononchulidae have also been

reported. Two closely related species, Mononchus truncatus and M. aquaticus have been studied in detail based on a large number of specimens including paratypes and neotypes from different localities. All the new species have been described in detail, illustrated adequately and compared with the related species. Almost all the known species have been illustrated and described briefly. Iotonchus antedontus, I. parebasidontus and Moronchulus nodicaudatus and the genus Cobbonchus are being reported for the first time from India.

During the course of the present investigations soil samples from different parts of India were examined for the presence of mononchs. However, specimens preserved in F. A. and prepared slides of these animals were also received from other sources as well. The present study includes not only the mononchs from India, but also from El Salvador, The Netherlands Poland, South Africa, England and Canada. If the sources of the material is from outside India, only then the name of the country has been mentioned.

A part of this thesis has already been published with due permission from the University authorities. This was done for the sake of priority, but in order to maintain uniformity the published taxa have also been included here as such.

MATERIAL AND METHODS

Soil sampling:

The soil samples were collected from around roots of various plants from depth of 3-10 inches. They were stored in polythene bags and were brought to the Laboratory for analysis. If not immediately processed they were kept in refrigerator maintained at 5-7°C until processing for isolation of the nematodes.

Processing of samples:

Soil was taken in a bucket filled 1/3rd with water and mixed thoroughly to get an uniform suspension. This was left undisturbed for about 15 seconds so as to allow the heavy soil particles to settle down at the bottom of bucket, while the nematodes and fine particles remain suspended. This suspension was passed through a coarse sieve to remove the debris and was collected in another bucket. The entire process was repeated twice, then the suspension finally obtained was quite free from debris and stones. The final suspension was filtered through a set of sieves of 300 mesh number (pore size 53 um). The nematodes and larger soil particles were retained on the sieves. The entire 'catch' was collected in a beaker.

Isolation of nematodes:

The aliquot collected as above was poured on a nylon filter-paper placed on a coarse sieve. This coarse sieve was

kept in petri-dish filled with small quantity of water which barely touched the bottom of the filter-paper. The nematodes pass through the filter-paper into the clean water of the petri-dish.

Killing and fixing:

The clear suspension of nematodes obtained as above was transferred to a large test tube. This test tube was kept undisturbed for 2-3 hours so that the nematodes could settle down at the bottom and the additional quantity of water could be discarded. The nematodes were then killed by using hot 8% formalin (double strength). Hot formalin proved to be a good fixative since it kills and fixes the worms immediately in their characteristic postures.

Mounting and sealing:

Temporary mounts if needed were prepared either in water or in 4% formalin. For permanent mounts, the nematodes were transferred to a mixture of glycerine and alcohol (glycerine 5 parts:30% alcohol 95 parts) in a desiccator at room temperature for about 2-3 weeks. The dehydrated nematodes were mounted in anhydrous glycerine either on glass slides or on metallic slides. The temporary mounts were sealed with a mixture of 50% wax and 50% vaseline and the permanent glycerine mounts with glyceel or 'cutex' nail polish.

Measurements and drawings:

de Man's (1884) formula for denoting the dimensions of

nematode was used. An ocular micrometer was used for taking measurements. All the diagrams were drawn with the help of a camera lucida.

In the text um stands for μm.

NOTES ON THE MORPHOLOGY OF MONONCHIDA

Body posture:

The members of the order Mononchida are cosmopolitan. They can easily be distinguished even at low magnification from other nematode groups because of their large barrel-shaped, strongly sclerotized buccal cavities. Upon fixation, they generally assume a ventrally arcuate posture, often 'C' shaped. The pre-vulval body is either only slightly curved or almost straight, but the post-vulval region generally shows a distinct curvature of varying degrees. A few species, however, retain a straight line posture.

Body wall:

The outer layer of cuticle is generally smooth without external markings, but sometimes the inner layers are marked with fine striations. The thickness of the cuticle varies considerably from one to 12 um. The body pores may or may not be visible, when present their arrangement does not show any definite pattern but is different in different species.

The hypodermis secretes the cuticle and is linked to the somatic muscle cells by fibres. It is this layer which is thickened in the dorsal, ventral, and lateral positions to form four hypodermal chords. These chords protrude into the pseudo-coelomic cavity in between the somatic muscles and divide them in four quadrants.

The lateral chords are prominent structures occupying 1/6th to 1/3rd of body-width near midbody.

The somatic muscles have one of their surface applied to the hypodermis and the other projecting into the body cavity. This layer is one cell thick and is continued along the entire length of the body. The cells are arranged logitudinally.

Lip region:

The lip region is generally marked off from the body by a depression or a slight constriction, usually wider than the adjoining body.

The en face view is hexagonal; the lips are equal in size and similar in shape which may either be subangular or rounded or rarely amalgamated. The lips bear six papillae in the inner circlet and a variable number in the outer-circlet. These papillae may be accompanied with dot-like structures on either side.

Amphids:

The amphids are in pairs, located below the lateral lips and are believed to function as chemoreceptors. They are usually goblet or cup-shaped and may vary in size as well as in shape. The width of apertures and the position of amphids are also variable. The shape and position of amphids, and the width of amphidial apertures are of diagnostic value. The

amphidial chamber is followed by a duct which leads to a wide pouch-like structure known as sensillar pouch. The distance of sensillar pouch from the amphidial aperture is of little taxonomic value.

Buccal cavity:

From the taxonomic point of view the buccal cavity is the most important part of this animal. Its shape, size and the type, and position of the armature forms the basis for generic identification (Plate No. I & II). The general shape of the buccal cavity is variable and may be globular, oval, prismoidal or rectangular. The length and the width are useful characters at specific level.

The walls of buccal cavity in the suborder Mononchina are formed by two sets of strongly cuticularized plates. The walls are very prominent due to heavy cuticularization. The anterior set is more vertical and more prominent, followed by the oblique basal plates. Each of these sets have one dorsal and two subventral plates. The dorsal wall of the vertical plate bears a tooth which varies in position, shape and size. This tooth may be located anywhere in the buccal cavity, i.e., from base to anterior half in the buccal cavity. This is present in anterior half in Monorchus, Mylorchulus, Prionchulus, Prionchulellus, Crassibucca, Polyonchulus, Cranonchulus etc., in posterior half in Judonchulus, Miconchus, etc., and in the

centre in Prionchuloides etc. However, within a genus the position of dorsal tooth may also vary (e.g., Iotonchus, Anatonchus, Hadronchus). The tooth apex may be massive or minute in size, triangular or digitate in shape, and it may project forward (e.g., Mononchus, Mylonchulus, Iotonchus, and Miconchus), lies almost perpendicular (e.g., Prionchulellus) or points backward (e.g., Anatonchus). The subventral walls of the buccal cavity may also bear one or two subventral teeth at level of the dorsal tooth (e.g., Miconchus) or posterior (e.g., Mylonchulus and Crassibucca). It has been observed that subventral teeth are of same size as dorsal tooth when the three occur at same level, otherwise they are generally smaller. Both the subventral walls as a rule have identical armature, but the shape and size of the teeth themselves may vary. They may be triangular, digitate, rose thorn-like etc. Their apices are oriented forward or backward. The buccal cavity is armed with peg-like structures, called denticles on the subventral walls, arranged in transverse rows (e.g., Mylonchulus), longitudinal rows (e.g., Polyonchulus) or irregularly in patches (e.g., Cranonchulus). The oblique basal plates bear "foramina" at subventral positions.

The members of the suborder Bathyodontina have a different type of stoma than Mononchina. It is narrow consisting of several sections and is almost embedded in the oesophageal tissue. They are provided with a distinct ventro-sublateral tooth of varying size.

The species of the family Mononchulidae have hexaradiate cheilostome and prostome which is followed by triradiate parts. The dorsal one and one of ventro-sublaterals mesorhabdia in mesostome possess transverse rows of denticles. They have an acute posterior prolongation in case of Mononchulus. The denticulate ventro-sublateral mesorhabdion also bears tooth. In metastome, one of the ventro-sublaterals metarhabdion, either on right or left, bears a large and grooved tooth. This subventral large tooth is a different structure from that found in Mononchina. The posterior cylindrical part (telostome) remains triradiate and the thickness of three telorhadia may decrease slightly posteriad.

The stoma of Bathyodontus is also different in shape from that of Mononchulidae. The oral opening is hexaradiate and the stoma becomes triradiate like Mononchulidae. Here the premesostome is tubular with a wide lumen. The left ventro-sublateral wall supports a minute tooth. Then comes a cylindrical central lumen and three radial tubuli. At the junction of oesophagus the central lumen rapidly diminishes in size and only the radial tubuli remain well developed.

Oesophagus:

The shape of the oesophagus is cylindroid, entirely muscular. The anterior portion is frequently expanded to enclose the base of stoma. The oesophageal lumen is strongly cuticularized and interrupted at intervals by orifices of oeso-

phageal glands.

The oesophagus, in the posterior half, consists of five (one celled) glands of different size and shape, i.e., one gland in the dorsal sector and four arranged in two pairs in the ventro-sublateral sectors. The dorsal gland (DN) is the anterior most of the five, except in the members of suborder Bathyodontina where it may be situated even below the first pair of subventral glands. It is comparatively larger in size. The orifice of dorsal gland (DO) is easily visible in the lumen anterior to dorsal gland (DN). The first pair of subventral glands (S_1N) are smaller in size and situated far below their orifices (S_1O). These two glands (S_1N) are located almost at the same level. The second pair of subventral glands (S_2N) is situated near the base of oesophagus or at about 90% or more of the oesophageal length from anterior extremity. The orifices of second pair (S_2O) are very close and generally situated slightly posterior to their glands but may be either at the level of S_2N or even far anterior. The S_2N are comparatively bigger than S_1N.

Thorne (1939), Chitwood and Chitwood (1950), Heyns (1963), Andrassy (1966), and others have illustrated the positions of the oesophageal glands and their orifices but their positions were not regarded to be of any taxonomic significance. Loof and Coomans (1968, 1970) were the first to give an exhaustive and systematic account of oesophageal glands and their orifices in many species of different genera and families of the order Dorylaimida.

Their study also included some species of mononchs which were considered under the order Dorylaimida. Since then Loof and Coomans (1972) and others have contributed informations on these structures and noted their consistency in different groups.

In the present work an attempt has been made to provide information, wherever possible, about the locations of oesophageal glands and their orifices in some species of mononchs reported here in this thesis (Plates: III - VI).

SUBORDER MONONCHINA

FAMILY MONONCHIDAE

1. Genus Mononchus

1.1. Mononchus truncatus

Specimens observed: Four females. Total oesophageal length 382-415 um. Locations as follows:

DO = 59.0-60.9	S_1O = 69-73	S_2N = 90-93
DN = 62.5-66.2	S_1N = 80-83	S_2O = 93-94
DO-DN = 3.6-5.5	S_1N-S_1O = 8.8-10.6	

2. Genus Clarkus

2.1 Clarkus papillatus

Specimens observed: Three females. Total oesophageal length 281-354 um. Locations as follows:

DO = 58.9-60.8 S_1O = 72-74 S_2N = 94-95

DN = 65.2-66.9 S_1N = 83-85 S_2O = 95-96

DO-DN = 4.8-6.1 S_1N-S_1O = 10.5-10.6

2.2 Clarkus shari

Specimen observed: One female. Total oesophageal length 487 um. Locations as follows:

DO = 59.7 S_1O = 71 S_2N = 97

DN = 62.4 S_1N = 81 S_2O = 98

DO-DN = 2.7 S_1N-S_1O = 10.3

3. Genus Prionchulus

3.1. Prionchulus muscorum

Specimens observed: Five females. Total oesophageal length 416-442 um. Locations as follows:

DO = 56.6-58.4 S_1O = 72-77 S_2N = 94-95

DN = 60.7-62.7 S_1N = 83-88 S_2O = 95-96

DO-DN = 3.9-4.8 S_1N-S_1O = 10.1-10.9

3.2 Prionchulus longus

Specimens observed: Two females. Total oesophageal length 554-567 um. Locations as follows:

DO = 53.2-55.0 S_1O = 70-71 S_2N = 94

DN = 57.7-60.1 S_1N = 80-81 S_2O = 96

DO-DN = 4.5-5.1 S_1N-S_1O = 9.9-11.4

FAMILY MYLONCHULIDAE

4. Genus Mylonchulus

4.1. Mylonchulus lacustris

Specimens observed: Four females. Total oesophageal length 321-390 um. Locations as follows:

DO = 50.1-55.3	S_1O = 63-68	S_2N = 90-93
DN = 54.8-59.3	S_1N = 74-78	S_2O = 92-94
DO-DN = 4.0-5.5	S_1N-S_1O = 9.3-10.9	

4.2. Mylonchulus brachyuris

Specimens observed: Two females. Total oesophageal length 338-342 um. Locations as follows:

DO = 58.7-59.0	S_1O = 71	S_2N = 90-91
DN = 62.8-63.1	S_1N = 79-84	S_2O = 93
DO-DN = 3.8-4.4	S_1N-S_1O=7.9-12.8	

4.3. Mylonchulus striatus

Specimen observed: One female. Total oesophageal length 285 um. Locations as follows:

DO = 57.1	S_1O = 70	S_2N = 92
DN = 63.5	S_1N = 79	S_2O = 92
DO-DN = 6.4	S_1N-S_1O = 8.7	

4.4. Mylonchulus agriculturae

Specimens observed: Three females. Total oesophageal length 310-389 um. Locations as follows:

DO = 56.1-56.8 S_1O = 70-73 S_2N = 90-93

DN = 59.3-60.3 S_1N = 79-81 S_2O = 92-93

DO-DN = 3.3-3.5 S_1N-S_1O = 8.0-9.0

4.5. Mylonchulus nainitalensis

Specimens observed: Three females: Total oesophageal length 283-314um. Locations as follows:

DO = 56.6-57.6 S_1O = 71-72 S_2N = 91-93

DN = 61.4-63.1 S_1N = 81-83 S_2O = 92-93

DO-DN = 4.8-5.6 S_1N-S_1O = 9.9-10.6

4.6. Mylonchulus mulvayi

Specimens observed: Five females. Total oesophageal length 289-322 um. Locations as follows:

DO = 53.1-56.4 S_1O = 66-70 S_2N = 90-93

DN = 58.2-62.0 S_1N = 76-79 S_2O = 93-95

DO-DN = 4.9-6.4 S_1N-S_1O = 9.1-11.0

FAMILY COBBONCHIDAE

5. Genus Cobbonchus

5.1. Cobbonchus parabulbosus n.sp.

Specimens observed: One female and one male. Total oesophageal length 324-325 um. Locations as follows:

DO = 54.1-55.2 S_1O = 73-74 S_2N = 93-94

DN = 61.7-62.6 S_1N = 85 S_2O = 97

DO-DN = 6.5-8.5 S_1N-S_1O = 10.2-11.4

FAMILY ANATONCHIDAE

6. Genus Anatonchus

6.1. Anatonchus adami n. sp.

Specimens observed: One female, one male and one fourth stage larva. Total oesophageal length 561-608 um. The locations as follows:

DO = 52.3-53.0	S_1O = 69-71	S_2N = 94
DN = 56.1-57.1	S_1N = 80-83	S_2O = 95-96
DO-DN = 3.1-4.8	S_1N-S_1O = 10.2-13.0	

FAMILY IOTONCHIDAE

7. Genus Iotonchus

7.1. Iotonchus mashhoodi n. sp.

Specimens observed: Two females. Total oesophageal length 301-305 um. Locations as follows:

DO = 54.7-55.4	S_1O = 74	S_2N = 93-94
DN = 64.2-64.4	S_1N = 84	S_2O = 95-96
DO-DN = 9.0-9.5	S_1N-S_1O = 10.2-10.3	

7.2 Iotonchus longicaudatus n. sp.

Specimens observed: Two females. Total oesophageal length 259-275 um. Locations as follows:

DO = 52.5-54.5	S_1O = 71-73	S_2N = 92
DN = 62.1-64.7	S_1N = 82-84	S_2O = 96-97
DO-DN = 9.6-10.2	S_1N-S_1O = 10.5-10.6	

7.3 Iotonchus coomansi n. sp.

Specimens observed: Four females. Total oesophageal length 234-254 um. Locations as follows:

DO = 54.8-58.6	S_1O = 70-71	S_2N = 95-97
DN = 62.1-64.1	S_1N = 80-85	S_2O = 95-96
DO-DN = 5.5-7.3	S_1N-S_1O = 12.8-15.4	

The S_2N are either situated at level of S_2O or slightly below.

8. Genus Hadronchus

8.1. Hadronchus shakili

Specimens observed: Three females and one male. Total oesophageal length 546-615 um. Locations as follows:

DO = 47.8-50.0	S_1O = 66-69	S_2N = 91-94
DN = 56.3-58.6	S_1N = 80-81	S_2O = 94-96
DO-DN = 6.3-9.2	S_1N-S_1O = 11.7-13.3	

SUBORDER BATHYODONTINA

FAMILY MONONCHULIDAE

9. Genus Mononchulus

9.1. Specimens observed: Five females. Total oesophageal length 285-310 um. Locations as follows:

DO = 46.4-53.3	S_1O = 62-64	S_2N = 91-93
DN = 74.6-77.8	S_1N = 76-77	S_2O = 91-92
DO-DN = 22.5-29.2	S_1N-S_1O = 12.1-13.4	

The DN is far behind from DO, even slightly posterior to S_1N. The S_2N are either situated at level of S_2O or slightly below.

Oesophago-intestinal junction:

Oesophago-intestinal junction or cardia is made up of transparent tissue, its lumen is trir diate lined with cuticle. Its size and shape differs in different species. The structure of the oesophago-intestinal junction offers a good taxonomic character in Mononchida. Due to the presence or absence of tubercles in the suborder Mononchina the junctions are of two types:

i) Tuberculate type.

ii) Non-tuberculate type.

i) Tuberculate type:

There is no marked change in the apparent width of oesophageal lumen as it passes into the transparent zone. The peripheral ends of the three arms of sclerotized lining become inflated, and greatly thickened forming conspicuous, hollow "tubercles" or knobs. From this point a narrow duct extends posteriorly, and forms the anterior part of the tripartite, funnel-shaped valves (e.g., superfamily Anatonchoidea).

ii) Non-tuberculate type:

There is an abrupt change in shape of oesophageal lumen when it becomes narrow at the base of oesophagus and opens into the transparent zone without forming tubercles (e.g., superfamily Mononchoidea).

In Bathyodontina, the oesophago-intestinal junction or cardia is different from Mononchina in having usually three large 'cardiac glands', of which one is located dorsally and the other two ventro-sublaterally, e.g., Mononchulus and Clonchus. These cardiac glands are absent in Bathyodontus.

Nerve ring:

The nerve ring is a conspicuous, broad collar-like structure, located at about one-third of the oesophageal length from anterior end. It shows a slight ventral slant. Its position in different species is of no taxonomic value in mononchs.

Excretory system:

The excretory system is usually obscure in mononchs but in few species the complete excretory system has been traced (Jairajpuri and Khan, 1975) while in some only the excretory pore and the ampulla have been observed. The excretory pore is situated on the ventral side, posterior to nerve ring, at about 27-35% of the oesophageal length from anterior extremity. The opening is marked by a prominent depression in the cuticle.

Intestine:

The intestine is a simple and straight tube-like structure, made up of a single layer of polygonal cells (mostly hexagonal). The granules in the intestine give it a tesselated appearance. The presence of rod-like structures or 'cilia' has also been noted, e.g., in Prionchulus muscorum at the inner surface of the intestinal tube. The cilia are more prominent at the anterior and hinder parts of the intestine. The intestine is more or less uniform in diameter, except in the region where the reproductive organs are present. The intestine is pushed dorsally due to the presence of reproductive organs. In Mylonchulus contractus the intestine is strongly contracted in the region of gonads. The heavily cuticularized portions of ingested nematodes or parts of other soil animals are often visible in the lumen of intestine. Sometimes the ingested nematodes can easily be identified up to genus within the lumen, if present in the anterior region of intestine.

Rectum and Anus/Cloaca:

The intestine of the female is connected posteriorly to a tube, the rectum, by means of unicellular sphincter muscles, the intestino-rectal valve. The rectum is more or less dorso-ventrally flattened, narrow tube. It is lined internally by cuticular layers, underneath it is a layer of large epithelial cells. Sometimes the unicellular rectal glands open into rectum through a common duct. Rectum opens externally through

a ventrally situated anus.

In males, the ejaculatory duct posteriorly joins the rectum and forms a common duct which is known as cloaca. This cloaca opens to the exterior through an aperture, the cloacal opening, which is situated on a raised area of body.

The female reproductive organs:

The female reproductive system consists of a vulva, followed by a short vagina. Each sexual branch consists of uterus, oviduct and an ovary.

The vulva is transverse, slit-like, located at 45-80% of body length from the anterior end. The vulval opening may be protruded or flushed with body or situated in a depression. The well developed muscles which act as dilator of the vulva are modified muscle cells of the somatic musculature. Several species of mononchs particularly the species of the genera Iotonchus, Hadronchus and Mylonchulus have prominently raised structures in the vulval region on the ventral surface of the body. These structures are called vulval papillae. The latter may be located in the pre- and/or post-vulval region. Their number is not only variable in different species but may even vary within the same species. However, their presence or absence is a good diagnostic character at specific level.

The vagina is rather short and rarely exceeds 1/2 the corresponding body-width. In large sized mononchs the vagina

is encircled by well developed sphincter muscles. These muscles are not so prominent in small sized mononchs. The vagina provided with cuticularized pieces at its junction with vulva. Exceptionally, the position of cuticularized pieces may be quite posterior to vulva-vagina junction (e.g., Iotonchus pagrii in which the cuticularized pieces are at 9-12 um from vulva). The cuticularized pieces show variations in shape (crescent, oval and rectangular) and size.

The female genital tract may be amphidelphic, monoprodelphic or mono-opisthodelphic. The sexual branches are generally well developed. The uterus is generally a wide, sac-like structure (uterine chamber). The wall of the uterus is well developed muscular with circular and oblique fibres. The lining is composed of squamous epithelium. The uterus may function as a sperm-storage organ and the fertilization occurs in this region. The oviduct is made up of high columnar epithelial cells and consists of a narrow distal and an enlarged proximal part . The latter may also serve as spermatheca. Generally the uterus and oviduct are separated by a tough, muscular structure known as sphincter. The ovaries are reflexed. The oocytes are arranged in single or double rows, their nuclei are usually prominent. The germinal zone is smaller in size than the growth zone.

Male reproductive organs:

The male reproductive organs comprise two opposite and outstreched testes, gonoducts differentiated in a vas deferens and an ejaculatory duct, a pair of spicules, gubernaculum, accessory pieces and the supplements.

Each testis has germinal zone and a growth zone. The distal part of each testis is occupied by spermatogonia. The spermatogonia are arranged in many rows and each has a distinct nucleus. The proximal part of each testis is usually filled with sperms which may vary in shape and size. The two testes are joined by a pair of short seminal vesicles which are dilated portions of the male gonoduct. The seminal vesicles form a single vas deferens which is the main part of the male gonoduct. This is usually partly tubular and partly glandular, and joins the ejaculatory duct. The lumen of ejaculatory duct gradually narrows posteriorly and joins the rectum to form cloaca. The cloaca opens to the exterior through the cloacal aperture.

Most mononchs have spicules which are slender crescent-shaped with a knobbed head and a bidentate terminus. The gubernaculum is usually crescent shaped but may also be variable. The lateral accessory pieces apparently occur in all species of mononchs, except in Clarkus papillatus, Mylonchulus hawaiiensis. These pieces are paired and occur on either side of the terminal

area of spicules. The ventromedian supplements begin near the cloacal opening or within the range of spicules. However, they may begin more anteriorly.

The shape and exact length along the median line of spicules is very important from taxonomic point of view. The shape and length of gubernaculum and lateral accessory pieces is also important taxonomically. The number and arrangement of ventromedian supplements (spaced, contiguous, spaced regularly or irregularly), and the area occupied by supplements is important.

Tail:

The shape and length of tail varies greatly. The tail may be filiform (e.g. Mononchus), elongate-conoid (e.g., Iotonchus and Hadronchus etc.). Some species have hemispheroid to obtusely rounded tails (e.g., Mylonchulus orbitus and M. striatus etc.). The caudal pores are generally obscure and have not been given much taxonomic importance. The length and shape of the tail is regarded as the most important diagnostic character.

Caudal glands:

Three unicellular glands are usually present in the anterior part of the tail. In those species where they are well developed, they have duct which opens to the exterior. This opening is guarded by well developed cuticularized structures

known as spinneret. In some species these glands are poorly developed without the duct or the spinneret. The glands are arranged either in group or tandem. The spinneret is situated terminally (e.g., Mylonchulus index, M. mulveyi) or subterminally (e.g., Mylonchulus contractus etc.). Sometimes the spinneret has a valve plug guided by a long muscle, e.g., Oionchus. In case of subterminal spinneret either it is subdorsal or subventral. The presence, absence and location of spinneret is very important taxonomically.

HISTORICAL REVIEW OF THE ORDER MONONCHIDA JAIRAJPURI, 1969

Dujardin (1845) was the first to observe these nematodes when he described three species from fresh water as Oncholaimus muscorum, Oncholaimus fovearum and Enoplus crassiusculus. Bastian (1865) proposed the first genus of mononchs, Mononchus, to accommodate his five new species, viz., M. truncatus, M. papillatus, M. macrostoma, M. tunbridgensis, and M. cristatus. He (l.c.) also transferred the three species of Dujardin under Mononchus. During 1865-1916 several new species were added and the total number of species became 28 in this group. Cobb (1916) proposed five subgenera under the genus Mononchus, viz., Mononchus, Prionchulus, Mylonchulus, Iotonchus and Anatonchus. He also stated that all these subgenera would ultimately be raised to full generic rank. Cobb (1917) published an excellent monograph on mononchs in which he proposed another subgenus Sporonchulus and described 32 new species so that the number of known species of mononchs became 60 under the above six subgenera. Micoletzky (1922) reduced this number of species to 41 only. Wu and Hooppli (1929) were the first to raise the subgenus Prionchulus to full generic status.

The second phase in the history of mononchs started when Chitwood (1937) recognized the genera Mononchus and Prionchulus and proposed the family Mononchidae to accommodate them and the remaining four subgenera. The family Mononchidae was placed under the superfamily Tripyloidea, suborder Enoplina, order

Enoplida. De Coninck (1939) while describing and illustrating a male and several juveniles of Mononchus (Anatonchus) tridentatus de Man, 1876 regarded the subgenus Anatonchus at the generic level. Altherr (1950, '53) raised the subgenera Iotonchus and Mylonchulus respectively to full generic level. Penak (1953) was the first to consider Sporonchulus as an independent genus. So by the year 1953, all the six subgenera proposed by Cobb had attained full generic status.

Andrassy (1958) revised the whole group of monorchs and added five more genera to the family Mononchidae, viz., Brachonchulus, Coponchus, Granonchulus, Judonchulus and Miconchus. Clark (1960, '63) added many species in this group, discussed morphology, evolution, and relationship of mononchs with Dorylaimoidea. The oesophago-intestinal junction was studied in detail by Clark (1960a) in different species and the presence or absence of tubercles at the junction formed a strong basis of classification. According to Clark (1961b) the mononchs share more features with Dorylaimoidea than Trypiloidea and consequently he placed this group under suborder Dorylaimina. Clark (l.c.) proposed the superfamily Mononchoidea and a family Bathyodontidae for the reception of the genera Bathyodontus Fielding, 1950; Microlaimus Andrássy, 1956; and Clonchus Cobb, 1913. s'Jacob and Loof (1962) synonymised Microlaimus with Bathyodontus. De Coninck (1965) transferred

the genus Mononchulus Cobb, 1918 from Oncholaimidae to Bathyodontidae, and proposed two subfamilies under Bathyodontidae viz., Bathyodontinae (with Bathyodontus and Isolaimium) and Mononchulinae (with Mononchulus, Clonchus and Stephanium). Andrassy (1976) has considered the latter genus a synonym of Rahmium Andrassy, 1973.

Mulvey (1961a & b, '62, '63a & b, '67a & b) published an excellent series of papers on mononchs in which he described a large number of species, redescribed the already known species either with the help of type material or different populations collected from various parts of the world, and accordingly emended the definition of many genera. Mulvey and Jensen (1967) added 16 new species and the following four new genera to Mononchoidea: Crassibucca, Hadronchus, Polyonchulus and Prionchulellus from Nigeria. Jensen and Mulvey (1968) reported 24 species, of which five were new to Science. Coetzee (1965, '66, '67a & b, '68) also added a good number of species in this group from Sourth Africa. During the last period of the second phase the other contributions were made by Buangsuwon and Jensen (1966), Yeates (1967) and Altherr (1968).

The third phase in the history of mononchs started when they were given the rank of suborder Mononchina under the order Dorylaimida by Kirjanova and Krall (1969) who also proposed a new genus Tigronchus. Jairajpuri (1969) gave mononchs their due place in the phylum Nematoda by raising this group to an ordinal rank Mononchida. Jairajpuri (1969, '70a & b, '71)

published important papers on this group from India. He also gave an outline classification of the order Mononchida and proposed a new superfamily Bathyodontoidea for the family Bathyodontidae; a new family Mononchulidae for the subfamily Moronchulinae; new family Mylonchulidae, and its two new subfamilies Mylonchulinae (with Mylonchulus and Polyonchulus) and Sporonchulinae (with Sporonchulus, Granonchulus, Prionchuloides, Judonchulus and Braconchulus); new family Cobbonchidae for Cobbonchus; new family Anatonchidae for Anatonchus, Miconchus and Crassibucca; and the new family Iotonchidae for Iotonchus, Hadronchus and Prionchulellus.

Coomans and Loof (1970) proposed a new suborder Bathyodontina for Bathyodontus and Cryptonchus transferred from family Ironidae, and gave the superfamily rank to the families Anatonchidae and Mononchulidae. At the same time they preferred to keep the suborders Bathyodontina and Mononchina under the order Dorylaimida. Jairajpuri (1971) accepted the revised classification of Coomans and Loof but retained the order Moronchida. In recent years the following genera have been added: Magronchulus Andrassy, 1972; Tectonchus Tsalolikhin, 1974; Tigronchoides Ivanova and Dzhuraeva, 1971 and Oligonchulus Andrassy, 1976. Lordello (1970), Eroshenko (1972), Andrassy (1973), and Baqri & Jairajpuri (1973) have published important papers on this group. Andrassy (1976) considers both Tigronchus and Tigronchoides as synonyms of Anatonchus. The present

author doubts the validity of Oligonchulus because in some other species of Mylonchulus e.g., M. mulveyi, the denticles are also smaller in number but the reproductive system is monoprodelphic. However, Tigronchus has been retained as valid because of its exceptionally long recurved teeth.

In the present work the classification as given by Jairajpuri (1971) has been followed. Two new genera, Actus under the family Mononchidae and Parecrassibucca under the family Anatonchidae have been added. Now the total number of genera in Mononchida has become 26 with more than 200 species. The genus Cryptonchus has not been considered a mononch under the family Bathyodontidae as suggested by Coomans and Loof (l.c.).

DIAGNOSES OF TAXA

ORDER MONONCHIDA JAIRAJPURI, 1969

Diagnosis: Stoma strongly sclerotized bearing tooth or teeth, subventral walls with or without denticles. Amphids small, cup-like, their apertures below lateral lips. Oesophagus almost cylindrical; oesophageal glands unimucleate, one dorsal and two pairs of subventrals, their orifices posterior to nerve ring. Excretory pore obscure. Males with ventromedian supplements, two identical spicules and gubernaculum. Caudal glands with a terminal or subterminal spinneret usually present.

Type suborder: Mononchina Kirjanova and Krall, 1969

SUBORDER MONONCHINA KIRJANOVA & KRALL, 1969

Diagnosis: Mononchida. Stoma large and wide, not embedded in oesophageal tissue, heavily sclerotized, at least with one large dorsal tooth. Dorsal oesophageal gland nucleus located behind dorsal oesophageal gland orifice, but anterior to first subventral gland opening, first subventral gland nuclei far behind first subventral gland orifice.

Type superfamily: Mononchoidea (Chitwood, 1937) Clark, 1961

SUBFAMILY MONONCHOIDEA (CHITWOOD, 1937) CLARK 1961

Diagnosis: Mononchina. Head broad, rounded or truncated, either set off or continuous with body. Stoma thick, strongly sclerotized, barrel or cup-shaped, tapering at base, its dorsal side bearing a large immovable dorsal tooth. Subventral teeth present or absent; if present, may be as large as dorsal tooth or smaller. Oesophago-intestinal junction non-tuberculate. Cuticle well developed, lateral accessory pieces present.

Type family: Mononchidae Chitwood, 1937.

FAMILY MONONCHIDAE CHITWOOD, 1937

Diagnosis: Mononchoidea. Dorsal tooth usually large, single, pointing forward; may or may not be opposed by a denticulated or non-denticulated longitudinal ribs on subventral walls.

Type subfamily: Mononchinae (Chitwood, 1937).

SUBFAMILY MONONCHINAE (CHITWOOD, 1937)

Diagnosis: Mononchidae. Lips and labial papillae poorly developed, lip region almost continuous with body. Dorsal tooth usually small, in anterior half of buccal cavity. Ovaries paired; spicules and accessory pieces extremely long and slender. Tails elongate with rounded terminus. Caudal glands, their ducts and spinneret well developed.

Type and only genus: Mononchus Bastian, 1865

SUBFAMILY PRIONCHULINAE ANDRASSY, 1976

Diagnosis: Mononchidae. Lips and labial papillae well developed, lip region set off from body. Dorsal tooth usually large, may or may not be opposed by a denticulate or non-denticulate longitudinal ridge. Tail short and conoid, caudal glands and spinneret generally absent or obscure except in the genus Actus.

Type genus: Prionchulus (Cobb, 1916) Wu & Hoeppli, 1929.

FAMILY MYLONCHULIDAE JAIRAJPURI, 1969

Diagnosis: Mononchoidea. Dorsal wall bears a large tooth opposed by several rows of denticles, arranged in transverse rows or scattered or both. Tail generally short, conoid, arcuate with well developed caudal glands and spinneret.

Type subfamily: Mylonchulinae Jairajpuri, 1969

SUBFAMILY MYLONCHULINAE JAIRAJPURI, 1969

Diagnosis: Mylonchulidae. Dorsal tooth in anterior half of buccal cavity, denticles arranged in two to several transverse rows. Subventral teeth generally present. Caudal glands and spinneret well developed.

Type genus: Mylonchulus (Cobb, 1916) Altherr, 1953

SUPERFAMILY CRICONEMOIDEA JAIRAJPURI, 1969

Diagnosis: Tylenchulidae. Denticles on the subventral wall of the buccal cavity not arranged in transverse rows, but scattered (with the exception of Criconchulus where in addition to scattered denticles, one transverse row also present).

Type genus: Criconchulus (Cobb, 1917) Penrak, 1953

FAMILY CRICONCHIDAE JAIRAJPURI, 1969

Diagnosis: Nolonchoidea. Dorsal and subventral teeth nearly equal in size, situated at same level or posteriorly. Tail short and conical; caudal glands and spinneret well developed.

Type and only genus: Criconchus Andrassy, 1958

SUPERFAMILY ANATYLENCHOIDEA (JAIRAJPURI, 1969) COOMANS & LOOF, 1970

Diagnosis: Nolonchina. Stoma thick-walled, strongly sclerotized, broad at anterior and and flat at base. One dorsal and two subventral teeth present. Oesophago-intestinal valve tuberculate.

Type family: Anatylenchidae Jairajpuri, 1969

FAMILY ANATONCHIDAE JAIRAJPURI, 1969

Diagnosis: Anatonchoidea. Dorsal and subventral teeth almost equal in size. Tail usually elongate, conoid; caudal glands and spinneret poorly developed, may be absent.

Type Subfamily: Anatonchinae (Jairajpuri, 1969)

SUBFAMILY ANATONCHINAE (JAIRAJPURI, 1969)

Diagnosis: Anatonchidae. Dorsal and subventral teeth, equal in size and located at same level, retrorse. Tail elongate; caudal glands and spinneret usually present.

Type genus: Anatonchus (Cobb, 1916) De Coninck, 1939.

SUBFAMILY MICONCHINAE ANDRASSY, 1976

Diagnosis: Anatonchidae. Dorsal and subventral teeth nearly of equal size, generally basal, situated at same level and their apices directed anteriorly. Caudal glands and spinneret rarely present.

Type genus: Miconchus Andrassy, 1958.

FAMILY IOTONCHIDAE JAIRAJPURI, 1969

Diagnosis: Enoplida. Dorsal tooth pointing forward; subventral teeth either absent or arranged longitudinally. Tail long; caudal glands and spinneret poorly developed or absent.

Type genus: Iotonchus (Cobb, 1916) Altherr, 1950

SUBORDER BATHYODONTINA COOMANS & LOOF, 1970

Diagnosis: Enoplida. Stoma narrow, embedded almost in oesophageal tissue, composed of several sections, weakly to strongly sclerotized. One distinct tooth of varying size located ventro-subdorsolaterally, with or without denticles. Dorsal oesophageal gland nucleus far behind dorsal oesophageal orifice, sometimes at level of first subventral gland nuclei, first subventral gland nuclei far behind first subventral gland opening.

Type superfamily: Bathyodontoidea (Clark, 1961) Jairajpuri, 1969

SUPERFAMILY BATHYODONTOIDEA (CLARK, 1961) JAIRAJPURI, 1969

Diagnosis: Bathyodontina. Stoma elongate, rhabdions weakly sclerotized. Mural tooth very small. Denticles may be present at anterior part of stoma. Dorsal oesophageal gland

nucleus anterior to first subventral gland nuclei . Second subventral gland nuclei far behind second subventral gland opening.

Type and only family: Bathyodontidae Clark, 1961

FAMILY BATHYODONTIDAE CLARK, 1961

Diagnosis: Bathyodontoidea. Stoma very long and narrow, composed of three sections, a cylindrical anterior part, a shorter much thicker and a narrow middle portion, and a posterior longer tubular part. Mural tooth at the junction of the two parts. Denticles are at the base of anterior part of stoma. Tail short and rounded with caudal glands and terminal duct.

Type and only genus: Bathyodontus Fielding, 1950

SUPERFAMILY MONONCHULOIDEA (DE CONINCK, 1965) COOMANS & LOOF, 1970

Diagnosis: Bathyodontina. Stoma strongly sclerotized, with a single large mural tooth and with several rows of denticles on ventral wall. Dorsal oesophageal gland nucleus at level of first subventral oesophageal gland nuclei . Second subventral gland nuclei about same level as second subventral gland opening.

Type and only family: Mononchulidae (De Coninck, 1965)
Jairajpuri, 1969

FAMILY MONONCHULIDAE (DE COCLEN, 1965) JAIRAJPURI, 1969

Diagnosis: Mononchuloidea. Stoma long and deep with thick walls, consisting of two portions, a much thicker and shorter anterior part, and a thinner and longer posterior portion. A large mural tooth present at anterior thicker portion. Denticles generally present. Tail short, hemishperoid with caudal glands and terminal duct.

Type genus: Mononchulus Cobb, 1918

KEY TO MONONCHIDA UP TO GENERA

1. Buccal cavity large and wide with a large dorsal tooth, not fully embedded in oesophageal tissue; dorsal oesophageal gland nucleus located anterior to the orifice of first pair of subventral glands ..... Mononchina 2

   Buccal cavity elongate and narrow with a subventral tooth, embedded almost in oesophageal tissue; dorsal oesophageal gland nucleus located below the orifice of first pair of subventral glands or even posterior to glands .... Bathyodontina 23

2. Buccal cavity tapering at base; oesophago-intestinal valve non-tuberculate ..... Mononchoidea 3

   Buccal cavity broad and flat at base; oesophago-intestinal valve tuberculate ..... Anatonchoidea 15

3. Subventral and dorsal teeth nearly equal in size .... Cobbonchidae, Cobbonchus

   Subventral teeth, if present, much smaller (denticulate) than dorsal tooth 4

4. Subventral teeth absent, if present, they are arranged along a longitudinal rib ..... Mononchidae 5

   Subventral teeth (denticles) may be in transverse rows or scattered or both ..... Mylonchulidae 8

5. Lips and labial papillae poorly developed; tail elongate; caudal glands and spinneret well developed ..... Mononchus

   Lips and labial papillae well developed; tail generally short, conoid; caudal glands and spinneret poorly developed

except in Actus 6

6. Subventral wall of buccal cavity without longitudinal ribs.. ..... Actus

Subventral walls of buccal cavity with longitudinal ribs.... 7

7. Buccal cavity with subventral denticulate longitudinal ridge ..... Prionchulus

Buccal cavity with or without subventral non-denticulate longitudinal ridge ..... Clarkus

8. Denticles arranged in two to several transverse rows .... Mylonchulinae 9

Denticles scattered (in Granonchulus with an anterior transverse row in addition to scattered denticles) .... Sporonchulinae 11

9. Denticles arranged in one transverse row..... Margaronchulus

Denticles arranged in two or more transverse rows 10

10. Denticles arranged in two transverse rows; longitudinal denticulate rib present ..... Polyonchulus

Denticles arranged in several transverse rows; longitudinal denticulate rib absent ..... Mylonchulus

11. Denticles in one group arranged in two or more rows .... Sporonchulus

Denticles in two groups 12

12. Dorsal tooth in anterior half of stoma 13

Dorsal tooth in middle or posterior half of stoma 14

13. Transverse row of denticles single along with irregularly arranged denticles ..... Cranonchulus

Transverse rows of denticles several, along with irregularly arranged denticles at the base of stoma ..... Brachonchulus

14. Apex of dorsal tooth pointing forward ..... Judonchulus

Apex of dorsal tooth perpendicular to dorsal wall ..... Prionchuloides

15. Subventral and dorsal teeth nearly equal in size ..... Anatonchidae 16

Subventral teeth either absent or if present in two longitudinal rows of denticles ..... Iotonchidae 21

16. Dorsal and subventral teeth directed posteriorly 17

Dorsal and subventral teeth directed anteriorly 18

17. Subventral and dorsal teeth of moderate size.... Anatonchus

Subventral and dorsal teeth exceptionally large, their apices reaching base of buccal cavity ..... Tigronchus

18. Dorsal tooth in posterior half, opposed by two subventral teeth of equal size ..... Miconchus

Dorsal tooth in anterior half, subventral teeth in the posterior half 19

19. Dorsal tooth opposed by a pair of small denticles 20

Dorsal tooth not opposed by a pair of small denticles ..... Paracrassibucca

20. Subventral teeth in posterior half; caudal glands and spinneret absent ..... Crassibucca

Subventral teeth in posterior third; caudal glands and spinneret present ..... Tectonchus

21. Subventral teeth absent ..... Iotonchus

Subventral teeth present 22

22. Both longitudinal ribs extending anteriorly as a loop in buccal cavity ..... Prionchulellus

Longitudinal ribs not forming loops..... Hadronchus

23. Stoma thin and narrow, mural tooth very small; dorsal oesophageal gland nucleus anterior to first pair of subventral oesophageal gland nuclei.....
..... Bathyodontoidea, Bathyodontidae, Bathyodontus

Stoma comparatively thicker, mural tooth grooved and very large; dorsal oesophageal gland nucleus at level of first pair of subventral gland nuclei.....
..... Mononchuloidea, Mononchulidae 24

24. Female gonads double, amphidelphic..... Rahmium

Female gonad single, prodelphic 25

25. Buccal cavity provided with a broad, large subventral mural tooth ..... Clonchus

Buccal cavity provided with three teeth of which the subventral one is the largest ..... Mononchulus

SUBORDER MONONCHINA KIRJANOVA AND KRALL, 1969

SUPERFAMILY MONONCHOIDEA (CHITWOOD, 1937) CLARK, 1961

FAMILY MONONCHIDAE CHITWOOD, 1937

GENUS MONONCHUS BASTIAN, 1865

Diagnosis: Mononchidae. Lips and labial papillae poorly developed. Lip region almost continuous with body. Buccal cavity elongate, cylindroid, thin-walled, tapering at base. Dorsal tooth small, apex directed forward. Gonads didelphic. Spicules and accessory pieces extremely long and slender. Tails similar in both sexes, elongate-conoid to cylindroid with a rounded terminus. Caudal glands and spinneret well developed. Aquatic or found in wet soil.

Type species: Mononchus truncatus Bastian, 1865

In the present study the following three species of the genus Mononchus have been studied: M. truncatus Bastian, 1865; M. aquaticus Coetzee, 1968; M. niddensis Skwarra, 1921. A good number of specimens of these three species, including 5 neotypes of M. truncatus and 3 paratypes of M. aquaticus, were obtained through the courtesy of Drs. V. Coetzee, W. C. Clark, M. W. Kouts and R. H. Mulvey. On the basis of the type specimens of M. truncatus and M. aquaticus as well as the specimens of the latter species collected from different localities in Uttar Pradesh, India, the intra-specific variations

have been reported in detail and a diagnostic Table of these two closely related species has also been provided.

MONONCHUS TRUNCATUS BASTIAN, 1865

(Plate: VII)

Dimensions:

(Coetzee specimens) Barberton, South Africa population:

Females (3): L = 1.52-1.61 mm; a = 28-32; b = 3.6-3.8; c = 7-8; V = 55-57.

(Clark specimens) Falmouth, Swan pool, England population:

Females (5): L = 1.68-1.92 mm; a = 20-31; b = 3.5-4.3; c = 7-8; V = 52-62.

(Mulvey specimens) Bog soil, Blackburn, Canada population:

Females (29): L = 1.87 mm (1.48-2.16 mm) a = 34 (26-46); b = 3.9 (3.3-4.5); c = 8 (6-9); V = 53 (42-59).

Description*:

Body almost straight upon fixation, tapering towards both ends. Cuticle smooth, about 2 um thick. Lip region slightly set off, 22-29 um (26 um) wide, 6-8 um (7 um) high. Amphids cup-shaped with slit-like apertures, anterior to apex of dorsal tooth; 3-4 um (3 um) wide, and 15-20 um (16 um) from anterior extremity. Sensillar pouches below dorsal tooth apex.

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*The average values have been given in parenthesis.

Oral aperture hexaradiate; buccal cavity barrel-shaped, triradiate, 31-52 um (44 um) long and 17-38 (22 um) wide. Dorsal wall of buccal cavity bears a large tooth, the apex of which lies at 24-39 (34 um) from base of stoma. Oesophago-intestinal junction non-tuberculate. Nerve ring at 120-161 um (148 um) from anterior end of body. Rectum 25-39 um (28 um) long.

Vulva slit-like with slightly thickened lips. Vagina extending across 1/3rd body-width at vulva. Small cuticularized places present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed; each ovary has 9-11 oocytes. Uterus and oviduct separated by a well developed sphincter. Tail 153-226 um (196 um) long, elongate, tapering uniformly, curved ventrally in posterior half. Three compact well developed caudal glands are present with ducts leading to a terminal spinneret.

Remarks: The species, Mononchus truncatus is greatly variable as reported by Andrassy (1958), Mulvey (1967a). This fact is also supported by the present study of this species which is based on a large number of specimens obtained through various sources. There are significant variations in the size of body, buccal cavity and tail. However, the relative positions of amphidial slits, dorsal tooth etc., are fairly constant.

MORONCHUS AQUATICUS COETZEE, 1968

(Plates: VIII - XI)

Coetzee (1968) described M. aquaticus from South-West Africa, closely related to the type species, M. truncatus Bastian, 1865. The latter species is greatly variable as reported by Andrassy (1958) and Mulvey (1967a). Jairajpuri (1970a) recorded a species of Moronchus from different localities in India and identified it as M. aquaticus. This identification was mainly based on the descriptions of M. aquaticus by Coetzee (1968) and that of M. truncatus by Clark (1960b) who also designated a neotype of the latter species. If the variations of the different morphological characters of M. truncatus as given by Andrassy (1958) and Mulvey (1967a) are taken into account, M. aquaticus can not be considered as a valid species. According to Jairajpuri (1970a) M. truncatus perhaps represents a complex involving two or three different species.

A number of specimens of Moronchus species were obtained from different localities in Uttar Pradesh. They were identified as Moronchus aquaticus based on the descriptions given by Coetzee (1968) and Jairajpuri (1970a). In the present study three females obtained through the courtesy of Dr. V. Coetzee have also been included. The entire study deals with the morphology and intra-specific variations of taxonomic characters to determine the validity of M. aquaticus.

Dimensions: Table I.

Description:

Body almost straight upon fixation, tapering considerably posteriorly beyond anus. Cuticle smooth, 1-2 um thick on body (thickest on tail). Lip region continuous or slightly wider than the adjoining body, 21-22 um wide and 6-8 um high. En face view (Plate: VI, A) hexagonal, showing 6 heart-shaped lips, two lateral and four submedians; the inner circlet consists of 18 labial papillae, 3 on each lip; the outer circlet has only 10 papillae, one each on the lateral lips and two each on the four submeidian lips. Amphids small, cup-shaped with slit-like apertures, situated anterior to apex of dorsal tooth. Amphidial chamber followed by amphidial canal with a swollen sensillar pouch, near the middle of buccal cavity.

Oral aperture hexaradiate. Buccal cavity narrow, barrel-shaped (Plate: IV, A-F). Walls of buccal cavity formed by two sets of heavily cuticularized plates: a vertical set and an oblique set, each set with one dorsal and two subventral plates. Dorsal plate of the vertical set bears a large tooth, the apex of which points forward and its edges are posteriorly sloping from the apex and merging imperceptibly with the walls of the buccal cavity. The subventral walls of the vertical set possess an indentation, situated slightly below the apex of dorsal tooth. Buccal cavity inarched above the tooth apex as well as

at the base where it gradually narrows and imperceptibly joins the oesophageal lumen. Cross sections of buccal cavity (Plate: XI, B,C) show that the three plates (dorsal and two subventrals) of both the vertical and oblique sets are almost similar in shape, but the former is comparatively wider with thicker and strongly sclerotized walls. In cross section of the vertical plates, presence of the dorsal tooth distinguishes the dorsal from the subventral walls.

Oesophagus almost cylindirical, strongly muscular, slightly expanded where it surrounds the basal part of buccal cavity, narrowing a little as it proceeds towards the level of nerve ring, gradually widening below towards the base. Walls of oesophageal lumen very thick, heavily sclerotized, occupies 1/3rd-1/2 of corresponding oesophageal width in anterior half and 1/4th-1/3rd of corresponding oesophageal width in posterior half. The oesophago-intestinal junction non-tuberculate, its lumen triradiate with non-sclerotized walls (Plate: XI, F). Intestine sac-like, flattened dorsally in the region of gonads; walls with flattened, polygonal cells (mostly hexagonal); cross section of intestine below base of oesophagus showing a single layer of 9 epithelial cells (Plate: XI, G). Intestinal cells appear irregular, possess a distinct nucleus and miscellaneous types of granules. Lumen of intestine lined by homogeneous, hyaline layer, 'rod' or 'cilia' not seen. Rectum narrow dorsoventrally flattened, provided with three uninucleate

rectal glands which open into the rectum through a duct. Anus a transverse slit.

Vulva transverse, slit-like, post-equatorial in position with a pair of ventrally situated vulval glands (as reported by Coomans and Lima, 1965 in Anatonchus amicinae) anterior as well as posterior to vulva (Plate: X, G); Vagina thick-walled, about 1/3rd of corresponding body-width. Small, oval cuticularized structures present at vulva-vagina junction. Gonads amphidelphic; sexual branches fully developed having the usual parts, i.e., uterus, oviduct and ovary. Uterus a wide, sac-like structure. Proximal part of the oviduct swollen, made up of glandular coils, followed by a narrow distal part. Uterus and oviduct separated by a distinct sphincter. Ovaries reflexed, each consisting of 10-15 oocytes, arranged in a single row.

Uterine egg measures 81 x 59 um.

Tail 94-156 um, elongate, tapering uniformly, curved ventrally in posterior half with slightly clavate tip. Three unicellular glands present in the anterior region of tail which open to the exterior terminally by a common duct. The nature of ventral curvature of the tail and the arrangement of the caudal glands show variations (Plate: IX, G-M).

Musculature:

Somatic musculature: A cross section of the body at level of anterior part of oesophagus shows 4 hypodermal chords

(Plate:XI, D), one dorsal, one ventral and two laterals. The four interchordal zones are provided with 16 somatic muscles of the platymyarian type, four in each zone. Each cell is flat, and its fibrillar zone situated next to the hypodermis and consisting of numerous ribbon-shaped fibres. The sarcoplasmic part contains a distinct nucleus and is situated towards the body cavity.

Cephalic muscles: The cephalic muscles consist of two series (Plate: X, A)

a) Labial muscles: These consist of 6 muscles attached anteriorly to the lips and posteriorly to the oesophagus. They bifurcate anteriroly, each band running to a different lip, so that each of the labial muscles control two adjacent lips and each lip is controlled by two different mucles.

b) Stomatal muscles: They consists of 6 muscles attached to the vertical plates of the stome. Two of them are sub-dorsal, two subventral and four sub-lateral. Buccal cavity opens by the contraction of the stomatal muscles.

Vulval muscles: Four pairs of dilator vulvae, 4 anterior and 4 posterior to vulva. They are inserted ventrolaterally in the hypodermis (Plate: X, F).

Anal muscles: Two bands of anal muscles present on each side, the anterior one directed upwards and poster or one directed downwards (Plate: X, I).

caudal muscles: Three bands of caudal muscles on each side, run parallel to each other, about one anal body-width posterior to anus (Plate: X, I).

Discussion: Mononchus truncatus Bastian, 1865, type species of the genus, was reported by Andrassy (1958), Mulvey (1967a) and Clark (1960b) to be a variable species, specially in body length, size and shape of buccal cavity and the length of tail etc. Another species, Mononchus aquaticus was described by Coetzee (1968) from Cobabeb, South-West Africa. The differences of M. aquaticus from M. truncatus as given by Coetzee appeared insignificant. Since the latter species is already known as a variable species, it was suspected that the former may fall well within the range of M. truncatus.

Mononchus aquaticus was reported from India by Jairajpuri (1970a). Later on, some specimens of M. aquaticus were also collected from Etah, Saharanpur, Bareilly and Shahjahanpur districts which are similar to the specimens described by Jairajpuri (1970a). Three female paratypes of M. aquaticus obtained through the courtesy of Dr. Coetzee, five neotypes through Dr. Wouts and some additional specimens from Mr. R. H. Mulvey of M. truncatus have also been included in the present study. With this wealth of material it was easy to make comparison between the various populations of M. truncatus and M. aquaticus. M. aquaticus differs from M. truncatus in the anterior position of its amphidial apertures,

length and width of buccal cavity, position of dorsal tooth and the indentation on the subventral vertical walls of buccal cavity, and length of tail as may be seen from Table II.

TABLE II

DIAGNOSTIC CHARACTERS OF *M. AQUATICUS* AND *M. TRUNCATUS*

Characters	*M. aquaticus* (Indian & Coetzee's specimens)	*M. truncatus* (Clark's specimens)
Position of amphidial apertures from anterior end	8-11 um	16-20 um
Length of buccal cavity	29-31 um	45-50 um
Width of buccal cavity	14-16 um	18-22 um
% of dorsal tooth	77-81 %	74-77 %
Indentation	20-24 um	34-39 um
Tail length/index 'c'	94-156 um/9-12	249-283 um/6-8

TABLE I

Dimensions of Mononchus aquaticus

Populations	L (mm)	a	b	c	V	G_1	G_2	Lip width (μ)	Lip height (μ)	Width of amphid apertures (μ)	Position of amphid apertures from anterior end (μ)	Position of Nerve ring from anterior end (μ)	Width of buccal cavity (μ)	Length of buccal cavity (μ)	Dorsal tooth from base of stoma (μ)	Position of indentation from base of stoma (μ)	% of dorsal tooth in buccal cavity from base	Rectum length (μ)
Total mean :	1.54	29	4.4	10	51	9	9	22	6	3	10	128	15	30	24	21	78%	27
Entire range (37 ♀♀) :	1.30–1.79	22–37	4.2–5.0	9–12	46–59	8–19	6–15	21–22	6–7	3–4	8–11	103–171	14–16	29–31	22–29	20–24	77–81%	25–32
Kasganj, Etah Mean :	1.58	27	4.9	10	51	11	11	22	6	3	10	133	14	31	29	22	78%	28
(Range 17 ♀♀) :	1.52–1.79	22–33	4.2–4.9	9–11	48–57	8–19	10–15	21–22	6–7	3–4	8–11	103–171	14–16	29–31	22–29	21–24	77–81%	26–29
Chabba Nagla Kasganj, Etah :																		
Mean :	1.55	32	4.4	10	50	10	8	21	6	3	9	120	14	30	23	22	78%	26
(Range 9 ♀♀) :	1.45–1.71	30–35	4.3–4.8	9–12	46–56	8–11	8–11	21–22	6–7	3–4	8–11	115–133	14–15	29–31	22–24	21–22	77–80%	26–29
Mirzhanpur Kasganj, Etah :																		
Mean :	1.51	30	4.4	10	52	7	8	22	6	3	11	133	15	30	24	21	78%	28
(Range 11 ♀♀) :	1.30–1.66	25–37	3.9–5.0	9–11	49–59	6–9	6–11	21–22	6–7	3	8–11	105–161	14–15	29–31	24	20–22	77–81%	25–32
Saharanpur (♀) :	1.47	26	4.5	12	53	7	7	22	7	3	10	104	15	28	22	21	80%	21
Shahjahanpur (♀) :	1.49	29	4.3	9	53	10	8	22	8	3	13	114	14	29	24	21	81%	27
Izzatnagar Bareilly :																		
Mean :	1.33	39	4.5	10	53	10	10	19	7	3	10	112	13	27	21	20	79%	25
(Range 3 ♀♀) :	1.14–1.53	34–44	4.3–4.9	9–11	54–55	9–10	9–11	18–20	6–7	3	8–11	94–128	13–14	27	21	21–22	79%	24–25
Laksar, Saharanpur (♀) :	1.57	30	4.9	12	48	10	10	21	6	3	10	95	15	29	24	20	81%	24
Gobabeb, South-West Africa :																		
(Coetzee specimens) :																		
Mean :	1.33	27	4.0	9	53	12	11	21	7	3	8	124	14	29	23	21	83%	24
(Range 3 ♀♀) :	1.27–1.37	26–28	3.9–4.2	8–9	50–57	11–13	11–14	21	6–7	3–4	7–10	114–142	13–14	29	22–24	20–21	76–81%	24–25

MORONCHUS MIDDENSIS SAVARA, 1921

(Plate: VII)

Dimensions:

Females (8): L = 2.94-4.20 mm; a = 30-36; b = 3.0-4.1 ; c = 14-17; V = 57-71.

Description:

Body upon fixation similar to M. truncatus and M. aquaticus. Cuticle smooth, 2-3 um thick. Lip region 39-42 um wide, 10-14 um high. Amphid apertures anterior to apex of dorsal tooth, 6-7 um wide, 18-25 um from the anterior extremity; sensillar pouches near middle of the buccal cavity. Buccal cavity large, 57-63x26-29 um. Dorsal tooth large, 49-56 um from the base of stoma; non-denticulate ridge on ventral vertical wall present. Oesophagus typical. Nerve ring at 190-210 um from anterior end of body. Rectum 49-56 um long.

Vulva transverse. Vagina extending about 1/3rd across the body, encircled by well developed sphincter muscles. Small cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed, each consisting of 15-17 oocytes. Uterus and oviduct separated by a well developed sphincter. Tail 80-120 um long, tapering uniformly, curved ventrally in posterior half; with three well developed and compact caudal glands leading to a terminal spinneret.

Locality: Specimen from Lake Hazen area, Northwest Territories, Canada (obtained through the courtesy of Mr. R. H. Mulvey).

GENUS CLARKUS JAIRAJPURI, 1970

Jairajpuri (1970) proposed the genus Clarkus for those species of Mononchus (sensu lato) which possess well developed lips; buccal cavity barrel-shaped; tail short conoid and arcuate; spicules and accessory pieces short and stout; and caudal glands absent or rudimentary, spinneret absent.

Diagnosis: Mononchidae. Lips and labial papillae prominent. Buccal cavity barrel-shaped, with or without a non-denticulate ventral ridge. Dorsal tooth generally small, apex directed forward, and situated in anterior half of buccal cavity. Oesophago-intestinal junction non-tuberculate. Gonads didelphic. Spicules and accessory pieces short and stout. Tails similar in both sexes, conoid, arcuate ventrally. Caudal glands poorly developed or absent; spinneret absent or inconspicuous.

Type species: Clarkus papillatus (Bastian, 1865) Jairajpuri, 1970

Three females of C. propapillatus (Clark, 1960) Jairajpuri, 1970 and a single female of C. sheri (Mulvey, 1967) Jairajpuri, 1970 reported hereunder were collected from Himachal

Pradesh in the recent years. Seven females of C. papillatus obtained through the courtesy of Prof. A. Coomans have also been included in the present study.

CLARIUS PAPILLATUS (BASTIAN, 1865) JAIRAJPURI, 1970

(Plate: XIII)

Dimensions:

Females (7): L = 0.84-1.17 mm; a = 18-23; b = 2.7-4.2; c = 12-17; V = 56-71.

Description:

Body almost 'C' shaped upon fixation, the curvature is more marked posteriorly. Cuticle smooth, 3-5 um thick at various places on body (thickest on tail). Lip region set off, 23-25 um wide, 6-9 um high. Amphids cup-shaped with slit-like apertures, 3-4 um wide, 10-12 um from anterior extremity, situated near the apex of dorsal tooth. Buccal cavity 25-28 x 14-16 um; apex of dorsal tooth 22-24 um from base of buccal cavity. Non-denticulate ridge on ventral vertical wall present. Oesophagus typical. Nerve ring at 98-108 um from anterior end. Oesophago-intestinal junction non-tuberculate. Rectum 20-25 um. Vulva transverse. Vagina short, small cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed, each consists of 9-12 oocytes. Uterine eggs

measure 69-81 x 34-36 um. Tail 67-92 um, conoid, ventrally arcuate, 2.0-2.5 anal body-widths long; caudal glands inconspicuous; spinneret absent.

Habitat and locality: Collected in The Netherlands, exact habitat and locality not known. The specimens were obtained through the courtesy of Prof. A. Coomans, Institute Voor Dierkunde, Gent, Belgium.

CLARKUS PROPAPILLATUS (CLARK, 1960) JAIRAJPURI, 1970
(Plate: XIV, Fig. A-F)

Dimensions:

Deodar population: Females (2): L = 1.26-1.46mm; a = 22-23; b = 3.4-4.0; c = 15-18; V = 67-68.

Weeds and grasses population: Female: L = 1.24; a = 24; b = 3.2; c = 20; V = 66.

Description:

Body almost 'C' shaped upon fixation, tapering slightly towards anterior end, but markedly posteriorly. Cuticle smooth. Lip region set off, 29-32 um wide, 10-12 um high. Amphids cup-shaped with slit-like apertures, 4-5 um wide, 11-12 um from anterior extremity, situated at level of dorsal tooth apex. Buccal cavity 32-36 x 18-21 um; apex of dorsal tooth 21-25 um from base of buccal cavity. Non-denticulate ridge on ventral

vertical wall present. Oesophago-intestinal junction non-tuberculate. Rectum 21-24 um long. Gonads amphidelphic. Ovaries reflexed. Tail 63-83 um or 1.7-2.5 anal body-widths long, arcuate-conoid with rounded tip. Caudal glands present; spinneret absent.

Habitats and localities:

(i) Deodar population: Soil around roots of Deodar Cedrus deodara, and other forest trees from Hadamba Road, Manali, Himachal Pradesh.

(ii) Weeds and grasses population: Soil around roots of weeds and grasses from Gulaba Army Camp, Manali, Himachal Pradesh.

CLARKUS SHERI (MULVEY, 1967) JAIRAJPURI, 1970
(Plate:XIV, Fig. C-D)

Dimensions:

Female: L = 2.15 mm, a = 31; b = 4.4; c = 15; V = 58.

Description:

Body almost 'C' shaped upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region set off, 38 um wide, 12 um high. Amphids cup-shaped; apertures 5 um wide, 14 um from anterior extremtiy, situated above the level of dorsal tooth. Buccal cavity 41 x 23 um. Apex of dorsal

tooth 30 um from base of buccal cavity. Non-denticulate ridge on ventral vertical wall present. Oesophago-intestinal junction non-tuberculate. Rectum 30 um long. Gonads amphidelphic. Ovaries reflexed. Tail 131 um, about 3 anal body-widths long, arcuate-conoid with rounded tip. Caudal glands and spinneret absent.

Habitat and locality: Soil around roots of Pinus sp. from Maranda, Palampur, Himachal Pradesh.

GENUS PRIONCHULUS (COBB, 1916) WU AND HOEPPLI, 1929

Diagnosis: Mononchidae. Lips and labial papillae prominent. Buccal cavity large and heavily sclerotized. Dorsal tooth large, pointing forward, situated in anterior half, opposed by two denticulate, longitudinal, sclerotized ridges. Gonads amphidelphic. Accessory pieces present or absent. Tail conoid, arcuate ventrally; caudal glands poorly developed or absent; spinneret inconspicuous or absent.

Type species: Prionchulus muscorum (Dujardin, 1845) Wu and Hoeppli, 1929

Cobb (1916) transferred Oncholaimus muscorum (Dujardin, 1845) to the subgenus Prionchulus under the genus Mononchus. Wu and Hoeppli (1929) gave generic rank to Prionchulus.

Prionchulus muscorum is cosmopolitan in distribution and has also been reported from different localities in India.

During the course of present study, this species has been collected from district Nainital. Two females of P. longus (Thorne, 1929) Andrassy, 1959 were present in the collection of moroncha sent by Prof. A. Coomans. Both P. muscorum and P. longus are described below.

PRIONCHULUS MUSCORUM (COBB, 1916) WU AND HOEPPLI 1929
(Plate XV, Fig. D-F)

Dimensions:

Females (5): L = 1.44-1.65 mm; a = 21-28; b = 3.4-3.6; c = 13-15; V = 65-67.

Description:

Body slightly ventrally curved upon fixation, tapering slightly anterior to base of oesophagus but markedly towards posterior end. Cuticle smooth 5-10 um thick (thickest on tail). Lip region marked off by a constriction, wider than adjoining body, 36-38 um wide and 15-17 um high. Amphids cup-shaped; apertures 4 um wide situated anterior to apex of dorsal tooth. Buccal cavity 38-42 x 25-27 um. Apex of dorsal tooth 30-32 um from base of stoma. Denticulate ridges very pronounced. Oesophago-intestinal junction non-tuberculate. Rectum 30-34 um long.

Vulva transverse. Vagina thick-walled, 19-21 um long.

Gonads amphidelphic. Uterus and oviduct separated by a well developed sphincter. Ovaries reflexed. Tail elongate-conoid, arcuate, 106-120 um long or about 3.0-3.5 anal body-widths long. Caudal glands poorly developed, spinneret absent.

Habitat and locality: Soil around roots of banana, Musa sp. from Mainital, U.P.

PRATYLENCHULUS LOLIUS (THORNE, 1929) ANDRASSY, 1958
(Plate: XVI)

Dimensions:

Females (2): L = 1.91-1.98 mm; a = 26-28; b = 4.0-4.2; c = 21-22; V = 65-68.

Description:

Body almost 'C' shaped upon fixation, tapering towards both the extremities. Cuticle smooth, 3-5 um thick. Lip region continuous with the body, 36-37 um wide, 5-6 um high. Amphids cup-shaped with slip-like apertures, 3-4 um wide, 13-15 um from anterior extremity. Buccal cavity 40-41 x 20-22 um. Apex of dorsal tooth anterior to amphidial apertures, 34-35 um from base of buccal cavity. Denticulate ridges very prominent. Oesophago-intestinal junction non-tuberculate. Rectum 30-31 um long.

Vulva transverse. Vagina thick-walled, encircled by sphincter muscles. Gonads amphidelphic. Ovaries reflexed, each consisting of 11-13 oocytes. Sphincter present at oviduct-uterus junction. Uterine egg measuring 71 x 51 um. Tail 90-95 um, 1.5-1.7 anal body-widths long, elongate-conoid, ventrally arcuate. Caudal glands absent.

Habitat and locality: Collected in The Netherlands, habitat and locality not known. Specimens obtained through the courtesy of Prof. A. Coomans.

GENUS *ACTUS* N. GEN.

Specimens from several localities in El Salvador appeared very similar to *Sporonchulus minutus* Gulvey, 1963. A striking feature of these specimens, as well as of *S. minutus*, is the nature of the subventral denticles which are similar to species of the genus *Prionchulus* (Cobb, 1916) Wu & Hoeppli, 1929. The present specimens and *S. minutus* have on each subventral wall a single row of a few (4-5) denticles. This is in contrast to other species of *Sporonchulus* (Cobb, 1917) Penner, 1953 where additional rows of irregularly scattered denticles are present (Viz., *Sporonchulus dentatus*, *S. recessus*, and *S. vagabundus*). They also resemble *S. ibitensis* (Carvalho, 1951) Andrassy, 1958, but the latter species differs by presence of 2-3 rows of denticles arranged along a longitudinal rib on each subventral wall. However, the status of *S. ibitensis* is not clear at the moment and it was regarded as species inquirenda by Jairajpuri (1971). Though close to *Prionchulus*, *S. minutus* and the present specimens differ from it in the absence of a longitudinal rib along which the subventral denticles are arranged. Also the denticles are few but comparatively larger. The present study concludes that *S. minutus* and the specimens from El Salvador belong neither to *Sporonchulus* nor to *Prionchulus* but represent a new genus for which the name *Actus* in honour of Professor A. C. Tarjan is proposed.

Diagnosis: Mononchidae. Buccal cavity about twice as long as wide. Dorsal tooth opposed by denticles on the subventral walls. Oesophago-intestinal valve non-tuberculate. Ovaries two, gonads reflexed. Tail short, conoid, with caudal glands and spinneret.

Type species: Actus minutus (Mulvey, 1963) n. comb.
syn. Sporonchulus minutus Mulvey, 1963

Other species: Actus salvadoricus n. sp.

Relationship: The new genus Actus resembles Prionchulus and Sporonchulus. From the former it differs in the absence of longitudinal ribs on the subventral walls of the buccal cavity and from the latter in the absence of additional rows of scattered denticles on the subventral walls.

The differences from Sporonchulus are considered to be of more fundamental nature and thus the new genus has been removed from this group (ie. Sporonchulinae, Mylonchulidae Jairajpuri, 1969), and placed under the family Mononchidae Chitwood, 1937 close to the genus Prionchulus.

ACTUS SALVADORICUS N. SP.

(Plate: XVII, Fig. A-F)

Dimensions:

Ilopango tobacco population (type): Holotype females:

L = 1.21 mm; a = 24; b = 4.3; c = 20; V = 64.

San Andres banana population: Female: L = 1.06 mm, a = 24; b = 4.0; c = 19; V = 63.

San Andres citrus population: Female: L = 0.85 mm, a = 20; b = 3.5; c = 17; V = 61.

Sonsonate citrus population: Female: L = 1.00 mm; a = 22; b = 3.5; c = 18, V = 63.

El Recreo coconut population: Female: L = 1.05 mm, a = 22; b = 4.0; c = 17; V = 63.

Description:

Body upon fixation ventrally arcuate in posterior half, tapering slightly anteriorly but markedly posteriorly. Cuticle smooth, 2-3 um thick at various places on the body. Lip region slighly set off, 23-24 um wide, 8-9 um high, slightly wider than the adjoining body. Amphids cup-like; apertures 3-5 um wide, situated at 9-11 um from anterior end of body.

Buccal cavity barrel-shaped, 24-26 um long, 14-15 um wide. Apex of dorsal tooth 18 um from base of stoma. Denticles medium-sized, arranged in two longitudinal rows of 4-5 each. Oesophagus typical. Oesophago-intestinal junction non-tuberculate. Nerve ring at 78-99 um from the anterior end of body. Rectum 20-23 um or about one anal body-width long.

Vulva transverse. Vagina extending about one-third across the body. Cuticularization present at vulva-vagina junction. Gonads amphidelphic; reflexed. Each ovary consisting of 8-12 oocytes. Oviduct and uterus not clearly demarcated. Tail 51-61 um, elongate-conoid, ventrally arcuate, 1.8-2.4 anal body-widths long. Caudal glands and a prominent terminal spinneret present.

Male: Not found

Type habitat and locality: Soil around roots of tobacco, Nicotiana tabacum, from Ilopango, El Salvador.

Other localities:

(i) Soil around roots of banana, Musa paradisiaca, and Citrus sp. from San Andres, El Salvador.

(ii) Soil around roots of Citrus sp., from Sonsonate, El Salvador.

(iii) Soil around roots of coconut, Cocos nucifera, from El Recreo, El Salvador.

Type specimen: Holotype female mounted on slide Actus salvadoricus/1; specimens from other localities mounted on slides Actus salvadoricus/2-5.

Differential diagnosis: The new species, Actus salvadoricus comes very close to the type A. minutus but differs in the anterior position of the amphids, the shape of the dorsal tooth, and in having a longer tail and a pronounced terminal opening to the caudal glands.

FAMILY MYLONCHULIDAE JAIRAJPURI, 1969

GENUS MYLONCHULUS (COBB, 1916) ALTHERR, 1953

Diagnosis: Mylonchulidae. Lip region marked off by a depression, distinctly wider than adjoining body. Buccal cavity with a large to massive dorsal tooth situated in anterior half to anterior third; subventral walls bear 3-8 transverse rows of denticles forming rasp-like areas. Two small subventral teeth may be present posterior to denticles. Female gonads amphidelphic or mono-prodelphic, rarely mono-opisthodelphic. Males rare. Tail usually short, variable in shape from conoid to hemispheroid. Caudal glands usually well developed, either grouped or tandem; spinneret present.

Type species: Mylonchulus minor (Cobb, 1893) Andrassy, 1958.

Species of the genus Mylonchulus are cosmopolitan in distribution. Jairajpuri (1970b) has reported 10 species, including 5 new, collected from 27 localities in India. During the course of present investigations, a large number of specimens were obtained from different sources in India as well as from El Salvador and The Netherlands. They represent 14 species, of which 6 are new to Science.

MYLONCHULUS STRIATUS (THORNE, 1924) ANDRÁSSY, 1958

(Plate: XV, Fig. A-C)

Dimensions:

Female: L = 0.92 mm; a = 27; b = 3.2; c = 71 V = 66.

Description:

Body upon fixation strongly curved ventrally posterior to vulva, tapering slightly towards both extremities. Cuticle smooth, 1-3 um thick (thickest on tail). Lip region slightly marked off, wider than adjoining body, 19 um wide and 11 um high. Amphids cup-shaped; apertures about 3 um wide, located at about posterior half of dorsal tooth. Buccal cavity 21 x 14 um. Apex of dorsal tooth 17 um from base of stoma. Transverse rows of denticles 6. Two small subventral teeth present below denticles. Oesophago-intestinal junction non-tuberculate. Rectum 19 um long. Vulva transverse. Vagina sclerotized distally. Gonads amphidelphic. Uterus and oviduct separated by sphincter. Ovaries reflexed. Tail rounded 13 um or 0.6 anal body-width long. Caudal glands poorly developed; spinneret absent.

Habitat and locality: Collected in The Netherlands, exact locality and habitat not known. Specimens obtained through the courtesy of Prof. Dr. A. Coomans.

MYLONCHULUS AGRICULTURAE COETZEE, 1967

(Plate: XVIII, Fig. A-B)

Dimensions:

Females (8): L = 0.67-1.02 mm; a = 22-24; b = 2.8-3.4; c = 17-24; V = 58-63.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 17-23 um wide, 6-8 um high. Amphid apertures 3-5 um wide, 9-12 um from anterior extremity. Buccal cavity 18-23 x 12-15 um. Apex of dorsal tooth at 15-20 um from the base of buccal cavity. Subventral walls bearing 5-6 rows of denticles. Submedian teeth present. Rectum 17-21 um long. Gonads amphidelphic. Ovaries reflexed. Tail 30-45 um, 1.1-1.4 anal body-width long, ventrally arcuate. Caudal glands tandem; spinneret subdorsal.

Habitats and localities: Soil around roots of sugarcane (Saccharum officinarum), cotton (Gossypium sp.) and maize (Zea mays) from Azaculpa, Las piedras and La Cruz respectively in El Salvador.

HYLONCHULUS BRACHYURIS (BÜTSCHLI, 1873) ALTHERR, 1953

(Plate: XIX, Fig. D-F)

Dimensions:

Females (4): L = 0.84-1.16 mm; a = 26-28; b = 3.0-3.6; c = 32-38; V = 59-68.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards extremities. Cuticle smooth. Lip region 20-24 um wide, 8-9 um high. Amphid apertures 3-4 um wide, 9-10 um from anterior extremity. Buccal cavity 21-23 x 14-15 um. Apex of dorsal tooth at 18-20 um from base of buccal cavity. Subventral walls bearing 6 rows of denticles. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Rectum 17-23 um long. Gonads amphidelphic. Ovaries reflexed with 7-9 oocytes. Tail 27-33 um, 1.1-1.4 anal body-width long, conoid with blunt terminus. Caudal glands grouped; spinneret subterminal.

Habitat and locality: Soil around roots of black gram, Phaseolus mungo, from Dhaulpur, Kulu, Himachal Pradesh.

MYLONCHULUS INCURVUS (COBB, 1917) ANDRÁSSY, 1958

(Plate: XX, Fig. A-B)

Dimensions:

Female: L = 1.12 mm; a = 34; b = 3.0, c = 34; V = 68.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 26 um wide, 6 um high. Amphid apertures 4 um wide, 12 um from anterior extremity. Buccal cavity 26 x 17 um. Apex of dorsal tooth at 21 um from the base of buccal cavity. Subventral walls bearing 6 rows of denticles. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Rectum 20 um long. Gonads amphidelphic. Ovaries reflexed. Tail 33 um, 1.3 anal body-width long, ventrally arcuate. Caudal glands tandem; spinneret terminal.

Habitat and locality: Soil around roots of pine apple, Ananas comosus from Coatepeque, El Salvador.

MYLONCHULUS INDEX (COBB, 1906) ANDRÁSSY, 1958

(Plate: XXI, Fig. E-G)

Dimensions:

West Bengal mango population: Females (3): L = 0.69-0.79 mm; a = 26-28; b = 2.7-3.1; c = 21-22; V = 69-72.

El Salvador chili population: Female: L = 0.81 mm; a = 26; b = 2.4; c = 26; V = 69.

El Salvador citrus population: Females (7): L = 0.64-0.86 mm; a = 23-34; b = 2.8-3.6; c = 21-25; V = 69-77.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 15-20 um wide, 5-6 um high. Amphid apertures 3-5 um wide, 9-12 um from anterior extremity. Buccal cavity 15-21 x 8-13 um. Apex of dorsal tooth 12-17 um from base of buccal cavity. Subventral walls bearing 5 rows of denticles. Submedian teeth absent. Oesophago-intestinal junction non-tuberculate. Rectum 14-16 um long. Gonads mono-prodelphic. Ovary reflexed with 12-14 oocytes. Post-uterine sac absent. Tail 30-40 um, about 1.5 anal body-width long, hemispheroid bearing a ventral finger-like projection. Caudal glands large, grouped; spinneret terminal.

Habitats and localities:

(i) Soil around roots of mango, Mangifera indica from Magurjan, West Bengal.

(ii) Soil around roots of chili, Capsicum sp. from La chacra, El Salvador.

(iii) Soil around roots of citrus from Sonsonate, El Salvador.

MYLONCHULUS MULVEYI JAIRAJPURI, 1970

(Plate: XXI, Fig. A-D)

Dimensions:

Nainital paddy population: Female: L = 0.91 mm; a = 77; b = 3.0; c = 21; V = 74.

West Bengal mango population: Females (11): L = 0.81-1.11 mm; a = 22-37; b = 2.8-3.4; c = 20-25; V = 62-77.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 16-18 um wide, 6-8 um high. Amphid apertures 2-4 um wide, 9-12 um from anterior extremity. Buccal cavity 17-19 x 10-12 um. Apex of dorsal tooth at 14-17 um from the base of buccal cavity. Subventral walls bearing 4 rows of denticles. Submedian teeth absent. Oesophago-intestinal junction non-tuberculate. Rectum 15-21 um long. Gonads mono-prodelphic. Ovary reflexed with 8-11 oocytes. Post-uterine sac absent. Tail 37-48 um, 1.6-2.0 anal body-widths long, elongate conoid. Caudal glands large, grouped; spinneret terminal.

Habitats and localities:

(i) Soil around roots of paddy, Oryza sativa, from Haldwani, District Nainital, Uttar Pradesh.

(ii) Soil around roots of mango, Mangifera indica, from Magurjan, West Bengal.

Single female specimen was found from each of the following habitats and localities in El Salvador:

(i) Soil around roots of rose from La chacra;

(ii) Soil around roots of coffee from Ranchador;

(iii) Soil around roots of citrus from Sonsonate;

(iv) Soil around roots of coconut from Sonsonate.

MYLONCHULUS LACUSTRIS (N. A. COBB in M. V. COBB, 1915)
ANDRASSY, 1958

(Plate: XVIII, Fig. C-E)

Dimensions:

Females (4): L = 1.21-1.49 mm; a = 22-29; b = 3.7-3.8; c = 25-29; V = 51-57.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 17-25 um wide, 8-10 um high. Amphid apertures 3 um wide, 10-11 um from anterior extremity. Buccal cavity 26-28 x 15-17 um. Apex of dorsal tooth at 18-23 um from base of buccal cavity. Subventral walls bearing 7 rows of denticles. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Rectum 18-24 um long. Gonads amphidelphic. Ovaries reflexed. Tail 42-53 um long, 1.4-1.7 anal body-width long, arcuate

conoid. Caudal glands in tandem; spinneret terminal.

Habitat and locality:

Soil around roots of mango, Mangifera indica, from Sambhal, District Moradabad, Uttar Pradesh.

MYLONCHULUS NAINITALENSIS JAIRAJPURI, 1970

(Plate: XVIII, Fig. F, G)

Dimensions:

Females (3): L = 0.95-1.11 mm, a = 23-28; b = 3.2-3.5; c = 34-38; V = 51-62.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth. Lip region 21-23 um wide, 7-8 um high. Amphid apertures 3-4 um wide, 9-11 um from anterior extremity. Buccal cavity 21-23 x 13-15 um. Apex of dorsal tooth at 17-19 um from base of buccal cavity. Subventral walls bearing 6 rows of denticles. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Rectum 17-20 um long. Gonads amphidelphic. Ovaries reflexed with 8-12 oocytes. Tail 22-30 um about one anal body-width long, bluntly conoid. Caudal glands tandem; spinneret subterminal.

Habitat and locality: Soil around roots of apple, Pyrus malus, from Katrin, Himachal Pradesh.

MYLONCHULUS HAWAIIENSIS (CASSIDY, 1931) ANDRASSY, 1958

(Plate: XX, Fig. C-D)

Dimensions:

Female (4): L = 0.80-0.96 mm; a = 26-29; b = 3.1-3.6; c = 26-30; V = 57-59.

Description:

Body ventrally curved upon fixation, tapering slightly anterior to base of oesophagus but markedly at posterior end. Cuticle smooth, 2-3 um thick (thickest on tail). Lip region 22-25 um wide, set off, wider than adjoining body. Amphids cup-shaped; their apertures slit-like, located anterior to apex of dorsal tooth, 9-10 um from anterior extremity, and about 3 um wide. Buccal cavity 20-23 x 12-14 um. Apex of dorsal tooth 13-15 um from base of stoma. Transverse rows of denticles 6; submedian teeth present. Oesophago-intestinal junction non-tuberculate. Rectum 17-20 um long. Vulva transverse. Gonads amphidelphic. Uterus and oviduct separated by sphincter. Ovaries reflexed. Tail elongate with slightly clavate terminus, 28-37 um long. Caudal gland in tandem; spinneret terminal.

Habitat and locality: Soil around roots of lady finger, Abelmoschus esculentus, from Government Agriculature Farm, Car Nicobar Island.

MYLONCHULUS CLAVATUS N. SP.

(Plate: XXII, Fig. A-C)

Dimensions:

Paratype females (4): L = 1.04-1.19 mm; a = 28-30; b = 2.9-3.5; c = 26-32; V = 62-74.

Holotype female: L = 1.27 mm; a = 28; b = 3.2; c = 37, V = 62.

Description:

Body ventrally arcuate upon fixation, tapering slightly anterior to base of oesophagus and towards tail end. Cuticle smooth, 3-4 um thick. Lip region set off, 25-30 um wide, 7-9 um high. Amphids small with slit-like apertures, 3-4 um wide, 10-12 um from anterior extremity. Buccal cavity 25-27 x 16-18 um. Apex of dorsal tooth at 19-22 um from base of buccal cavity. Subventral walls bearing 6 rows of denticles, the anterior and posterior most rows are prominent, the inner 4 rows consist of comparatively smaller denticles. Submedian teeth present. Oesophagus typical; oesophago-intestinal junction non-tuberculate. Nerve ring at 94-116 um from anterior extremity. Rectum 19-21 um, less than one anal body-width long.

Vulva transverse. Vagina thick-walled, cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Each sexual branch consists of a reflexed ovary with 8-10 oocytes.

Proximal part of oviduct made up of large glandular cells. Uterine egg measuring 92 x 40 um. Tail 33-42 um, less than 2 anal body-widths long, bluntly conoid in the anterior half of its length, then tapers abruptly to a slightly clavate terminus. Caudal glands large, grouped; spinneret terminal.

Male: Not found.

Type habitat and locality: Soil around roots of shoe-flower, Hibiscus rosasinensis, from Ferozpur, Punjab, India.

Type specimens: Collected in October, 1968 by Mr. Wahid Husain; holotype on slide M. clavatus/1; paratypes on slides M. clavatus/2-3.

Differential diagnosis: Mylonchulus clavatus n. sp., comes close to M. hawaiiensis (Cassidy, 1931) Andrassy, 1958 but differs in having a larger body (L = 0.87-0.98 mm in M. hawaiiensis), in the position of dorsal tooth (apex of dorsal tooth 14-18 um from the base of buccal cavity in M. hawaiiensis), a differently shaped tail (tail elongate with slightly clavate tip in M. hawaiiensis) and in having caudal glands grouped (caudal glands tandem in M. hawaiiensis).

MYLONCHULUS JANILI N. SP.

(Plate: XXII, Fig. D-G)

Dimensions:

Paratype females (4): L = 0.93-1.04 mm; a = 20-25; b = 3.0-3.1; c = 27-31; V = 62-65.

Holotype female: L = 1.00 mm; a= 25; b= 3.21; c= 31; V = 61.

Description:

Body ventrally arcuate posteriorly upon fixation, tapering slightly anterior to base of oesophagus and towards the posterior extremity. Cuticle smooth, 2-4 um thick. Lip region set off, 23-25 um wide, 9-10 um high. Amphids small; their apertures 3-4 um wide, 10-12 um from anterior extremity. Buccal cavity 22-27 x 15-16 um. Dorsal tooth large, apex at 18-21 um from base of buccal cavity. The subventral walls bear multiple transverse rows of denticles, anterior one prominent and regular, posterior ones not arranged in definite rows. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Nerve ring at 94-107 um from anterior end of body. Rectum 19-22 um, about one anal body-width long.

Vulva transverse. Vagina short; small cuticularized pieces at vulva-vagina junction present. Genitalia amphidelphic. Ovaries reflexed with 6-8 oocytes. Proximal part of oviduct

with large glandular cells. Tail 33-37 um, about one anal body-width long, conoid, ventrally arcuate, terminus blunt. Caudal glands tandem; spinneret terminal.

Male: Not found.

Type habitat and locality: Soil around roots of mango, Mangifera indica, from Nagurjan, West Bengal.

Type specimens: Collected in October 1969 by Mr. Mohd. Jamil Ahmad. Holotype on slide M. jamili/1; paratype on slides M. jamili/2-4.

Differential diagnosis: M. jamili n. sp. comes close to M. curvicaudus Mulvey and Jensen, 1967, but differs in the shape and size of buccal cavity; the number and arrangement of denticles and in having a longer tail (buccal cavity 23-25 x 12-15 um; denticles in 5-6 rows; tail length 27-28 um in M. curvicaudus).

The new species has been named after Mr. Mohd. Jamil Ahmad, Biology teacher, M. T. S. High School, Aligarh Muslim University, who collected the soil sample which yielded the new species.

MYLONCHULUS ACUNTICUS N. SP.

(Plate: XXIII)

Dimensions:

Paratype females (3): L = 1.39-1.40 mm; a = 26-32; b = 3.9-4.0; c = 22-25; V = 61-62.

Holotype female: L = 1.49 mm; a = 25; b = 4.3; c = 27; V = 62.

Description:

Body upon fixation ventrally arcuate posteriorly, tapering slightly towards both extremities. Cuticle smooth 2-3 um thick. Lip region set off, 27-30 um wide, 9-10 um high. Amphids small, their apertures 3 um wide, 12-13 um from anterior extremity. Buccal cavity 30-33 x 20-21 um. Apex of dorsal tooth at 24-25 um from base of buccal cavity. Subventral walls of buccal cavity bearing 6 rows of denticles, the anterior and posterior rows more prominent, the inner 4 rows less prominent. Submedian teeth present. Wall of buccal cavity prominently striated. Oesophago-intestinal junction non-tuberculate. Nerve ring at 97-113 um from the anterior extremity. Rectum 22-25 um, less than one anal body-width long.

Vulva transverse. Vagina thick-walled; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed with 11-13 oocytes. The oviduct has a narrow distal and an enlarged proximal part made up of large glandular

cells. Tail 55-64 um, about two anal body-widths long, elongate conoid. Caudal glands grouped; spinneret terminal.

Male: Not found.

Type habitat and locality: Soil around roots of paddy, Oryza sativa, from Pilibhit, Uttar Pradesh,

Type specimens: Collected in October, 1967 by Dr. Shakil Ahmad; holotype along with one paratype on slide M. aquaticus/1; two paratypes on slide M. aquaticus/2

Differential diagnosis: Mylonchulus aquaticus n. sp., comes closest to M. minor (Cobb, 1893) Andrassy, 1958 but differs in various body dimensions, size of buccal cavity (21-25 x 12-15 um in M. minor), and the shape of subventral teeth.

MYLONCHULUS ANDRASSYI N. SP.

(Plate: XIX, Fig. A-C)

Dimensions:

Paratype females (4): L = 1.01-1.15 mm; a = 23-24; b = 3.4-3.5; c = 24-31; V = 56-60.

Holotye female: L = 1.02 mm; a = 26; v = 3.5; c = 27; V = 58.

Description:

Body strongly arcuate ventrally upon fixation, tapering slightly towards both extremities. Cuticle smooth, 2-4 um thick. Lip region 21-24 um wide, 8-9 um high. Amphid apertures 3 um wide, 9-12 um from anterior extremity. Buccal cavity 21-26 x 14-16 um. Apex of dorsal tooth 17-20 um from the base of buccal cavity. Transverse rows of denticles 5; anterior one more prominent. Submedian teeth absent. Oesophago-intestinal junction non-tuberculate. Nerve ring at 88-98 um from anterior end of body. Rectum 18-21 um, about 2/3rd of anal body width.

Vulva transverse. Vagina thick-walled; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed with 7-10 oocytes. Proximal part of oviduct consists of glandular cells. Tail 33-48 um, conoid, ventrally arcuate, terminus blunt. Caudal glands in tandem; spinneret terminal.

Male: Not found.

Type habitat and locality: Soil around roots of maize, Zea mays, from Joarnagar, Mandi, Himachal Pradesh.

Type specimens: Collected in October, 1970 by Dr. M. Shamim Jairajpuri; holotype along with one paratype on slide M. andrassyi/1; three paratypes on slide M. andrassyi/2.

Differential diagnosis: Mylonchulus andrassyi n. sp. comes close to M. minor (Cobb, 1893) Andrassy, 1958 and M. incurvus (Cobb, 1917) Andrassy, 1958. From the former it differs in having no submedian teeth in the buccal cavity; in the position of amphid apertures (amphid apertures above the apex of dorsal tooth in M. minor); and in the shape of tail. From M. incurvus it differs in the dimension of the buccal cavity (buccal cavity 34-40 x 19-23 um in M. incurvus); in having lesser number of transverse rows of denticles (6-7 rows in M. incurvus); and a longer tail (c = 35-48 in M. incurvus).

The new species has been named after Dr. I. Andrassy.

MYLONCHULUS MODESTUS N. SP.

(Plate: XXIV, Fig. A-C)

Dimensions:

Paratype females (3): L = 0.99-1.09 mm; a = 23-25; b = 3.3-3.7; c = 25-28; V = 54-61.

Holotype female: L = 1.06 mm; a = 23; b = 3.5; c = 27; V = 59.

Description:

Body ventrally arcuate upon fixation, tapering towards both extremities. Cuticle smooth, 2-3 um thick. Lip region 23-24 um wide, 8-9 um high. Amphid apertures 3 um wide,

11-12 um from anterior end of the body. Buccal cavity 24-26 x 14-16 um. Apex of dorsal tooth at 18-22 um from base of buccal cavity. Transverse rows of denticles 6. Submedian teeth present. Oesophago-intestinal junction non-tuberculate. Nerve ring at 93-99 um from anterior end of body. Rectum 18-20 um less than one anal body-width long.

Vulva transverse. Vagina thick-walled; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed consisting of 7-9 oocytes. Proximal part of oviduct made up glandular cells. Tail ventrally arcuate, 39-46 um or about one anal body-width long. Caudal glands in tandem; spinneret terminal.

Male: Not vound.

Type habitat and locality: Soil around roots of paddy, Oryza sativa, from Nagrota, Kangra, Himachal Pradesh.

Type specimens: Collected in October, 1970 by Dr. M. S. Jairajpuri; holotype along with one paratype on slide M. modestus/1; two paratypes on slide M. modestus/2.

Differential diagnosis: Mylonchulus modestus comes close to M. hawaiiensis (Cassidy, 1931) Andrassy, 1958 but differs in having more posteriorly situated amphid apertures (amphid apertures above the apex of dorsal tooth in M. hawaiiensis); differently shaped cuticularized pieces at vulva-vagina

junction; shorter and differently shaped tail (tail more than 1.5 anal body width-long in M. hawaiiensis).

MYLONCHULUS MHERAI N. SP.

(Plate: XXIV, Fig. D-F)

Dimensions:

Paratype females (2): L = 1.01-1.07 mm; a = 24-26; b = 3.1-3.2; c = 31-33; V = 58-61.

Holotype female: L = 1.01 mm; a = 26; b = 3.1; c = 32; V = 59.

Description:

Body strongly ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth, 2-4 um thick. Lip region 23-25 um wide, 9 um high. Amphid apertures 3-4 um wide, 9-10 um from anterior end of the body. Buccal cavity 23-25 x 15-16 um. Apex of dorsal tooth 18-20 um from base of buccal cavity. Transverse rows of denticles 6. Submedian teeth absent. Oesophago-intestinal junction non-tuberculate. Nerve ring at 98-101 um from anterior extremity. Rectum 18-20 um, less than one anal body-width long.

Vulva transverse. Vagina short; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic.

Ovaries reflexed with 6-7 oocytes. Proximal part of oviduct consisting of glandular cells. Tail conoid, ventrally arcuate 31-33 um, slightly more than one anal body-width long, caudal glands grouped; spinneret terminal.

Male: Not found.

Type habitat and locality: Soil around roots of jungle plants from Dharamshala, Himachal Pradesh.

Type specimens: Collected in October, 1970 by Dr. M. Shamim Jairajpuri; holotype along with one paratype on slide M. kherai/1; remaining paratypes on slide M. kherai/2.

Differential diagnosis: Mylonchulus kherai n. sp., comes close to M. andrassyi n. sp. and M. incurvus (Cobb, 1917) Andrassy, 1958. From the former it differs in having 6 rows of transverse denticles (5 transverse rows of denticles in M. andrassyi); differently shaped tail; grouped caudal glands (caudal glands tandem in M. andrassyi). From M.incurvus it differs in having shorter body (L = 1.62-2.48 mm in M. incurvus); smaller buccal cavity (buccal cavity 34-40 x 19-23 um in M. incurvus); no submedian teeth (submedian teeth present in M. incurvus); shorter and differently shaped tail (tail 40-60 um in M. incurvus).

The new species has been named after Dr. S. Khera, Joint Director, Zoological Survey of India, Calcutta.

KEY TO SPECIES OF *MYLONCHULUS*

(Modified after Jairajpuri, 1970)

1. Female monodelphic 2
   Female didelphic 8
2. Female mono-opisthodelphic .....
   ..... *reversus* (Cobb, 1917) Andrassy, 1958
   Female mono-prodelphic 3
3. Caudal glands and spinneret absent 4
   Caudal glands and spinneret present 5
4. Post uterine sac absent ..... *silvaticus* Rizzhivin, 1971
   Post uterine sac present .... *caespitosus* Rizzhivin, 1971
5. Spinneret subterminal .....
   ..... *subterraneus* (Schneider, 1940) Andrassy, 1958
   Spinneret terminal 6
6. Post uterine sac present .....
   ..... *californicus* Jairajpuri, 1970
   Post uterine sac absent 7
7. Tail characteristically digitate .....
   ..... *index* (Cobb, 1906) Andrassy, 1958
   Tail elongate-conoid..... *mulveyi* Jairajpuri, 1970
8. Caudal glands and spinneret obscure or absent 9
   Caudal glands and spinneret present 13
9. Tail bluntly rounded .....
   ..... *striatus* (Thorne, 1924) Andrassy, 1958
   Tail conoid to cylindroid or conoid arcuate 10

10. Tail conoid becoming cylindroid in posterior half by a gradual narrowing 11

Tail conoid arcuate 12

11. Submedian teeth present ..... solus Mulvey, 1961

Submedian teeth absent .....

..... exacutus Jensen & Mulvey, 1968

12. Transverse rows of denticles 6; c = 30-42 .....

..... subsimilis (Cobb, 1917) Meyl, 1957

Transverse rows od denticles 7; c = 20-29 .....

..... psammophilus Yeates, 1967

13. Spinneret subterminal 14

Spinneret terminal 23

14. Spinneret subventral .....

..... rotundicaudatus (Skwarra, 1921) Andrassy, 1958

Spinneret subdorsal 15

15. Tail shorter (c = 61-69); clavate .....

..... bulbiferous Jensen & Mulvey, 1968

Tail longer (c = 50 or less); conoid to bluntly conoid.

..... 16

16. Intestine with characteristic contraction in tha region of gonads ..... contractus Jairajpuri, 1970

Intestine overlapping gonads 17

17. Submedian teeth absent..... ubis Clark, 1961

Submedian teeth present 18

18. Body length averaging 1.4 mm or more 19

Body length averaging 1.2 mm or less 21

19. Tail longer (c = 25), about 2 anal body-widths .....
..... parabrachyurus (Thorne 1924) Andrassy, 1958

Tail shorter (c = 40-50), about one anal body-width ....
..... 20

20. Buccal cavity larger, 30-36 x 16-20 um .....
..... brevicaudatus (Cobb, 1917) Altherr, 1954

Buccal cavity shorter, 20 x 13 um .....
..... obliquus (Cobb, 1917) Andrassy, 1958

21. Caudal glands grouped .....
..... brachyuris (Butschli, 1873) Altherr, 1953

Caudal glands tandem 22

22. Tail shorter (c = 40-46), bluntly conoid .....
.. .. nainitalensis Jairajpuri, 1970

Tail longer (c = 22-28), elongate conoid .....
..... agriculturae Coetzee, 1967

23. Tail obtusely rounded to hemispheroid 24

Tail conoid, elongate conoid, cylindroid or subdigitate.
.. .. 26

24. Body length 1.9 mm; buccal cavity 40 x 30 um .....
.... obtusicaudatus (Daday, 1899) Andrassy, 1958

Body length under 1.6 mm; buccal cavity under 30 x 18 um
..... 25

25. Vulval papillae present ....
..... orbitus Jensen & Mulvey, 1968
Vulval papillae absent ..... muradi Jairajpuri, 1970

26. Tail sharply bent near middle or slightly posterior to level of anus 27
Tail arcuate, conoid or elongate cylindroid 32

27. Tail sharply bent near middle, dorsal curvature smooth and even 28
Tail sharply bent near middle or slightly posterior to level of anus, dorsal curvature flattened or uneven posteriorly 29

28. Body length 1.6-2.4 mm; buccal cavity 34-40 x 19-23 um.
..... incurvus (Cobb, 1917) Andrassy, 1958
Body length about 1.0 mm; buccal cavity 23-24 x 15 um..
..... kherai n. sp.

29. Tail conoid, then strikingly cylindroid just posterior to level of anus .....
..... cavenis (Schneider, 1940) Andrassy, 1958
Tail conoid, then strikingly cylindroid in posterior half or less 30

30. Cylindroid part of tail about 1/3rd of tail length; vulval papillae absent .....
..... sigmaturus (Cobb, 1917) Altherr, 1953
Cylindroid part of tail about half of tail length or more; vulval papillae present 31

31. Body length averaging over 2 mm; six transverse rows of regularly arranged denticles .... sigmaturallus Mulvey, 1961

Body length averaging 1.3 mm; multiple transverse rows of irregularly arranged denticles .... dentatus Jairajpuri, 1970

32. Anterior lip of anus massive, overhanging; V = 72 .... subteruis (Cobb, 1917) Altherr, 1958

Anterior lip of anus not massive or overhanging; V= less than 70 33

33. Tail 2-3 anal body-widths long 34

Tail less than 2 anal body-widths long 37

34. Transverse rows of denticles 7 .. .. lacustris (N.A. Cobb in M. V. Cobb, 1915) Andrassy, 1958

Transverse rows of denticles 5-6 35

35. Buccal cavity 30-33 x 21 um submedian teeth well developed, hemispheroid ..... aquaticus n. sp.

Buccal cavity 21-26 x 12-18 um submedian teeth less developed or absent 36

36. Submedian teeth present, less developed, anteriorly pointed; amphid apertures anterior to the apex of dorsal tooth ..... minor (Cobb, 1893) Andrassy, 1958

Submedian teeth absent; amphid apertures below the apex of dorsal tooth .... andrassyi n. sp.

37. Tail elongate cylindroid to slightly clavate at terminus 38

Tail conoid, narrowing towards terminus 40

38. Tail dorsoventrally concave in the middle .... clavatus n. sp.

Tail only ventrally concave in the middle 39

39. Amphid apertures anterior to the apex of dorsal tooth; tail more than 1.5 anal body widths long .... hawaiiensis (Cassidy, 1931) Andrassy, 1958

Amphid apertures below the apex of dorsal tooth, tail about one anal body-width long ..... modestus n. sp.

40. Caudal glands in tandem ..... cereis Coetzee, 1967

Caudal glands grouped 41

41. Body length 1.45-1.48 mm; buccal cavity almost parallel-sided ..... arenicolus Clark, 1961

Body length 0.75-1.20 mm; buccal cavity prominently curved 42

42. Denticles arranged in 5-6 regular transverse rows; tail length 27-28 um ..... curvicaudus Mulvey & Jenson, 1967

Denticles irregularly arranged; tail length 33-35 um ... . jamili n. sp.

NOT INCLUDED IN THE KEY

M. insolitus Andrássy, 1968: Only mature male known, mature female unknown.

M. prodenticulatus Mulvey, 1961: Only mature male known; female unknown.

M. montanus (Thorne, 1924) Andrássy, 1958; Synonym of M. lacustris according to Mulvey & Jensen (1967).

M. clevicaudatus (Schuurmans Stekhoven & Teunissen, 1938) Andrassy, 1958: Because of the presence of a toothed rib in the buccal cavity, this species belongs to the genus Polyonchulus Mulvey & Jensen, 1967.

Species inquirendae: (because of inadequate descriptions)

M. saxcristatus (Merzheevskaya, 1961) Mulvey, 1961

M. japonicus (Cobb, 1917) Andrássy, 1958

M. denticulatus (Cobb, 1917) Andrássy, 1958

M. micrurus (Cobb, 1917) Andrássy, 1958

M. polonicus (Stefanski, 1915) Andrássy, 1958

M. spargus (Cobb, 1917) Andrássy, 1958

FAMILY COBBONCHIDAE JAIRAJPURI, 1969

GENUS *COBBONCHUS* ANDRASSY, 1958

Diagnosis: Cobbonchidae. Lip region slightly set off or continuous with body. Buccal cavity about twice as long as wide, with three anteriorly directed teeth. Dorsal tooth larger, and anterior to subventral teeth. Oesophago-intestinal junction non-tuberculate. Gonads amphidelphic, mono-opisthodelphic (Clark, 1960) or mono-prodelphic. Spicules simple, free. Gubernaculum complex. Tails in both sexes short, ventrally arcuate, conoid at first, becoming cylindroid distally. Caudal glands well developed; spinneret present.

Type species: *Cobbonchus palustris* (Cobb, 1917) Andrassy, 1958

The species described hereunder of *Cobbonchus* was found in a soil sample collected from district Nilgiri. Only one female and a male were found and they belong to a new species of this genus. This is the first record of the genus *Cobbonchus* from India.

COBBONCHUS PARABULBOSUS N. SP.

(Plate: XXV)

Dimensions:

Paratype male: L = 1.07 mm; a = 45; b = 3.4; c = 43; T = 50.

Holotype female: L = 1.08 mm; a = 37; b = 3.4; c = 49; V = 66.

Description:

Female: Body strongly curved ventrally in posterior half upon fixation; tapering slightly towards both extremities. Cuticle smooth, 1-2 um thick (thickest on tail). Lateral chords about 1/4th of corresponding body-width near middle. Lip region set off, wider than adjoining body, 16 um wide and 6 um high . Amphids cup-shaped; their apertures slit-like, 4 um wide, located near anterior end of buccal cavity. Sensillar pouches 9 um from amphidial apertures. Buccal cavity cylindrical, twice as long as wide, arching inwards anteriorly and somewhat pointed at base, 23 x 11 um. Apex of dorsal tooth 16 um or 70% from base of stoma. Subventral teeth smaller than dorsal tooth, their apices at 10 um or 43% from base of stoma. Oesophago-intestinal junction non-tuberculate. Nerve ring 87 um from anterior end. Rectum 14 um long.

Vulva transverse. Vagina sclerotized distally, extending inwards 12 um or less than 1/2 of corresponding body-

width. Gonads amphidelphic. Uteri filled with sperm. Uterus and oviduct separated by a well developed sphincter. Ovaries reflexed. Tail short conoid, rather bulbosus, slightly ventrally curved, 22 um or 1.2 anal body-width long. Caudal glands well developed; opening situated slightly dorsal.

Male: Similar to female in shape and general morphology. Buccal cavity 22 x 9 um. Apex of dorsal tooth 17 um or 77% from base of stoma. Apices of subventral teeth 9 um or 41% from base of stoma.

Testes paired, opposed, outstretched. Spicules 36 um or 1.6 anal body-width long medially. Gubernaculum 7 um long and lateral accessory pieces 9 um long. Supplements 6, spaced nearly at regular intervals. Copulatory muscles 20 in number, occupying the area anterior to supplement region. Tail similar to female, 26 um or 1.2 anal body-width long. Caudal glands present; opening situated slightly dorsal.

Type habitat and locality: Soil around roots of Tea from Dodabettar, Ooty, Nilgiri.

Type specimens: Collected by Dr. Ahsan Z. Zaidi in October, 1972; holotype female along with paratype male on slide Cobbonchus parabulbosus/1.

Differential diagnosis: Cobbonchus parabulbosus n. sp. comes close to C. rotundicaudatus Coetzee, 1968; but differs from it

in the length and shape of tail (c = 51, tail more bulbosus with small cylindroid tip in C. rotundicaudatus); caudal glands restricted much below anus (caudal glands extending beyond anus in C. rotundicaudatus); more spaced and lesser number of supplements (Supplements 17 and almost contiguous in C. rotundicaudatus); and differently shaped spicules and gubernaculum.

SUPERFAMILY ANATONCHOIDEA (JAIRAJPURI, 1969) COOMANS AND LOOF, 1970

FAMILY ANATONCHIDAE JAIRAJPURI, 1969

GENUS ANATONCHUS (COBB, 1916) DE CONINCK, 1939

Diagnosis: Anatonchidae. Buccal cavity wide and strongly cuticularized with one dorsal and two subventral teeth, all equal in size at same level and directed posteriorly. Female gonads amphidelphic. Oesophago-intestinal junction tuberculate. Tails in both sexes similar, long and usually becoming cylindroid. Caudal glands and spinneret may or may not be present.

Type species: ANATONCHUS TRIDENTATUS (DE MAN, 1876) DE CONINCK, 1939

The slides of mononchs supplied by Dr. Adam Szczygiel, Experimental Stn. of Pomology Research Inst., Brzezna, Poland, contained some specimens of the genus Anatonchus. These specimens upon identification were found to represent two new species which are described below.

ANATONCHUS ADAMI N. SP.

(Plate: XXVI.)

Dimensions:

Paratype males (2): L = 2.42-2.92 mm; a = 32-34; b = 4.0-4.4; c = 18-22; T = ?

Holotype female : L = 3.10 mm; a = 33; b = 4.1; c = 16; V = 69.

Description:

Female: Body ventrally arcuate upon fixation, tapering slightly anterior to base of oesophagus and markedly posteriorly. Cuticle smooth, 2-4 um thick. Lip region slighly set off from body, 53-60 um wide, 15-17 um high. Amphids cup-shaped; apertures 7-8 um wide, 15-20 um from anterior end of body. Buccal cavity large, nearly as long as wide, 42-69 x 42-60 um. Teeth situated in anterior third of buccal cavity. Oesophagus typical. Nerve ring at 167-195 um from anterior end. Rectum 47 um long.

Vulva transverse. Pre-vulval papillae 7, post-vulval 5, spaced irregularly. Cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed, each with numerous oocytes. Uterus large, separated from oviduct by a well developed sphincter. Tail 201 um or 3.7 anal-body-widths, elongate - conoid, ventrally arcuate. Caudal glands three, leading to a terminal opening through a duct.

Male: Body strongly curved in posterior third of its length. Spicules 96-101 um long. Cubarnaculum 21 um long. Lateral guiding pieces 13-14 um. Supplements elevated above level of cuticle, contiguous, 11-12 in number. Tail strongly curved ventrally, conoid, 138-152 um slightly more than two anal body-widths long with one caudal pore on each side.

Type habitat and locality: Not known. Specimens collected from cultivated fields in Poland by Dr. Adam Szczygiel.

Type specimens: Holotype female along with 2 paratype males on slide Anatonchus adami/1.

Differential diagnosis: Anatonchus adami n. sp., comes close to A. tridentatus (de Man, 1876) De Coninck, 1939 and A. ginglymodontus Mulvey, 1961. From the former it differs in having a wider buccal cavity (buccal cavity 34-36 um wide in A. tridentatus); shorter tail (c = 7-14 in A tridentatus); and in the presence of vulval papillae. From a ginglymodontus it differs in the size of buccal cavity (buccal cavity 42-48 x 40-42 um in A. ginglymodontus); and in the presence of pre- and post-vulval papillae.

The new species has been named after Dr. Adam Szczygiel.

ANATONCHUS MADIRI N. SP.

(Plate: XXVII)

Dimensions:

Holotype female: L = 2.66 mm; a = 39; b = 4.6; c = 11; V = 63.

Description:

Female: Body ventrally curved upon fixation, tapering slightly anterior to base of oesophagus and markedly posteriorly. Cuticle smooth, 2-4 um thick. Lip region slightly set off from body, wider than adjoining body, 64 um wide and 19 um high. Amphids cup-shaped, apertures 7-8 um wide and 19 um from anterior extremity. Buccal cavity large, nearly as long as wide, 64 x 60 um. Teeth situated in the anterior third of buccal cavity. Oesophago-intestinal junction tuberculate. Nerve ring 160 um from anterior end. Rectum 44 um long.

Vulva transverse. Pre- and post-vulval papillae 3, spaced irregularly. Vagina not sclerotized distally. Gonads amphidelphic. Uterus and oviduct separated by sphincter. Ovaries reflexed. Sperm not seen. Tail elongate-conoid, 308 um or 5 anal body-widths long. Caudal glands well developed, opening terminal.

Male: Not found.

Type habitat and locality: Specimens collected from cultivated fields in Poland, exact habitat and locality not known, obtained through the courtesy of Dr. Adam Szczygiel.

Differential diagnosis: Anatonchus nadiri n. sp. comes close to A. ginglymodontus Mulvey, 1961 but differs from it in having differently shaped and sized buccal cavity (buccal cavity 42-48 x 40-44 um in A. ginglymodontus); vagina not sclerotized distally and in the presence of three pre- and post-vulval papillae (vagina sclerotized distally and vulval papillae absent in A. ginglymodontus).

The new species has been named after Mr. Nadir Husain, father of the author.

GENUS MICONCHUS ANDRASSY, 1958

Diagnosis: Anatonchidae. Dorsal and subventral teeth approximately equal in size, directed anteriorly and situated in posterior half of buccal cavity. Oesophago-intestinal junction tuberculate. Female gonads amphidelphic or monoprodelphic. Tail elongate, its posterior section almost cylindrical, rarely conical. Caudal glands usually present; terminal opening present or absent.

Type species: Miconchus digiturus (Cobb, 1893) Andrassy, 1958

The collection of mononchs from El Salvador received through the courtesy of Dr. A. C. Tarjan contained two known and one new species of Miconchus which are described below:

MICONCHUS THORNEI MULVEY AND JENSEN, 1967

(Plate: XXVIII, Fig. D-E)

Dimensions:

El Salvador banana population: Female: L = 2.06 mm; a = 30; b = 3.7; c = 9; V = 64.

El Salvador cacao population: Female: L = 1.75 mm; a = 29; b = 3.4; c = 8; V = 63.

Description:

Body ventrally arcuate upon fixation. Cuticle smooth. Lip region set off, 44-47 um wide, 14 um high. Amphids cup-like; apertures 5-6 um wide, 14 um from anterior extremity. Buccal cavity 50-51 x 33 um. Dorsal tooth large, suprabasal in position; its apex 15-17 um from the base of buccal cavity. Subventral teeth of same size and position as dorsal. Rectum 29-35 um long. Gonads amphidelphic. Ovaries reflexed; uterus and oviduct separated by a well developed sphincter. Tail 220-225 um, about 5 anal body-widths long, elongate conoid, ventrally curved. Caudal glands three, large; spinneret terminal.

Habitat and locality: Soil around roots of banana, Musa paradisiaca and cacao from San Rafael Obrajuelo and El Recreo respectively, El Salvador.

MICONCHUS PARARAPAX MULVEY AND JENSEN, 1967

Dimensions:

Female: L = 1.07 mm; a = 32; b = 3.7; c = 7; V = 60.

Description:

Body ventrally arcuate upon fixation. Cuticle smooth. Lip region set off, 39 um wide, 15 um high. Amphids cup-like; apertures 6 um wide, 15 um from anterior extremity;

Buccal cavity 53 x 35 um. Dorsal tooth large, suprabasal in position; its apex 18 um from base of buccal cavity. Subventral teeth slightly smaller than dorsal tooth and at same level. Rectum 30 um long. Gonads amphidelphic. Ovaries reflexed; uterus and oviduct separated by a well developed sphincter. Tail 2-7 um or about 7 anal body-widths long, elongate conoid, ventrally curved. Caudal glands obscure, tail terminus rounded with terminal opening.

Habitat and locality: Soil around roots of maize, Zea mays, from Ranchador, EL Salvador.

MICONCHUS NOVUS N. SP.

(Plate: XXVIII, Fig. A-C)

Dimensions:

Holotype female: L = 1.68 mm; a = 26; b = 3.6; c = 14; V = 68.

Description:

Body ventrally arcuate upon fixation, tapering slightly towards both extremities. Cuticle smooth, 2-3 um thick. Lip region set off, 38 um wide, 18 um high. Amphids cup-like with slit-like apertures, 5 um wide and 18 um from anterior extremity. Buccal cavity 45 x 30 um. Dorsal tooth large, suprabasal in position; its apex at 18 um from base of

buccal cavity. Subventral teeth of same size and placed at same level as the dorsal tooth. Nerve ring at 122 um from anterior end of body. Rectum 30 um long, about half of anal body-width.

Vulva a transverse slit. Vagina short; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed with numerous oocytes. Uterus and oviduct separated by a well developed sphincter. Tail 119 um or 3.5 anal body-widths long, elongate-conoid, ventrally arcuate with narrow tip. Caudal glands, well developed; opening terminal.

Type habitat and locality: Soil around roots of sugarcane, Saccharum officinarum, from Ahuachapan, EL Salvador.

Type specimen: Holotype on slide Miconchus novus/1.

Differential diagnosis: Miconchus novus n. sp., comes close to M. studeri (Steiner, 1914) Andrassy, 1958, but differs in having bigger dorsal and subventral teeth, narrower tail tip and in the absence of other small teeth (dorsal and subventral teeth smaller, two rows of three very small teeth posterior to suprabasal teeth present, and more rounded tail tip in M. studeri).

GENUS PARACRASSIBUCCA N. GEN.

Two specimens of a 'tuberculate' mononch were found in the El Salvador collection. They possess a dorsal tooth in the anterior half of their buccal cavity and a pair of teeth on each of the subventral walls in the posterior half. They show some resemblance to the genus Miconchus but can immediately be separated from this genus in having a pair of subventral teeth on each of the subventral walls, and also in the anterior position of the dorsal tooth. They, however, very closely resemble the genus Crassibucca Mulvey & Jensen 1967 from which they differ in having the dorsal tooth not opposed by a pair of denticles on the subventral walls, and in each subventral wall bearing a pair of comparatively smaller teeth in the posterior half of the buccal cavity. This is in contrast to Crassibucca where the subventral teeth are almost as big as the dorsal and each subventral wall bears only one tooth. The author feels justified in proposing a new genus, Paracrassibucca for these El Salvador mononchs.

There are three species under Crassibucca, viz., C. penicula; C. macrocauda; and C. microdonta, all described by Mulvey and Jensen (1967). The last mentioned species which is described only from males is regarded as a species inquirenda because of the absence of these denticles opposite the dorsal

tooth and also because the female is unknown.

GENUS PARACRASSIBUCCA N. GEN.

Diagnosis: Anatonchidae. Buccal cavity longer than wide, walls fairly thick. Dorsal tooth situated in the anterior half; each subventral wall bears a pair of relatively smaller teeth in the posterior half of the buccal cavity. Oesophago-intestinal junction tuberculate. Female didelphic. Caudal glands and terminal opening present.

Type and only species: Paracrassibucca jenseni n. sp.

PARACRASSIBUCCA JENSENI N. SP.

(Plate: XVII, Fig. C-I)

Dimensions:

Paratype female: L = 0.67 mm; a = 22; b = 3.1; c = 17; V = 63.

Holotype female: L = 0.74 mm; a = 17; b = 3.4; c = 17; V = 62.

Description:

Body ventrally arcuate, tapering slightly anteriorly

but markedly posteriorly. Cuticle smooth. Lip region 20-23 um wide, 8-11 um high. Amphids cup-shaped, posterior to apex of dorsal tooth; amphidial apertures 3-4 um wide situated 11-13 um from the anterior extremity.

Buccal cavity about twice as long as wide, measuring 23-29 x 12-15 um. Dorsal tooth in the anterior half of buccal cavity. Subventral teeth two, slightly smaller than the dorsal tooth and situated in posterior half of buccal cavity. Oesophago-intestinal junction tuberculate. Nerve ring at 89-93 um from anterior end of body. Rectum 15-18 um long.

Vulva transverse. Vagina thick walled but short. Cuticularization present at vulva-vagina junction. Gonads amphidelphic, reflexed. Ovaries each consisting of 8-10 oocytes. Uteri short, not clearly demarcated from oviduct. Tail 49-54 um; elongate-conoid, ventrally arcuate. Caudal glands compact, with their duct leading to a terminal opening.

Male: Not found.

Type habitat and locality: Soil around roots of citrus from El Congo, El Salvador.

Type specimens: Holotype along with paratype mounted on slide Paracrassibucca jensen.i/1.

The new species is named after Dr. H. J. Jensen.

FAMILY IOTONCHIDAE JAIRAJPURI, 1969

GENUS IOTONCHUS (COBB, 1916) ALTHERR, 1950

Diagnosis: Iotonchidae. Dorsal tooth small to medium-sized, variable in position from near about base to anterior half of buccal cavity, subventral teeth absent. Oesophago-intestinal junction tuberculate. Gonads amphidelphic or mono-prodelphic. Tails variable in shape, but similar in both the sexes. Caudal glands and spinneret may or may not be present.

Type species: Iotonchus gymnolaimus (Cobb, 1893) Andrassy, 1958

The present study on the genus Iotonchus is based on 14 populations from different localities in India, 3 localities in El Salvador and one locality in The Netherlands. They belong to 4 known and 5 new species. Iotonchus antedontus Mulvey, 1963 and I. parabasidontus Mulvey and Jensen, 1967 are being recorded for the first time from India.

IOTONCHUS TRICHURUS (COBB, 1917) ANDRASSY, 1958

(Plate: XXIX, Fig. A-D)

Dimensions:

Female: L = 1.62 mm; a = 45; b = 4.9; c = 4.5; V = 66.

Description:

Body ventrally curved upon fixation, tapering slightly anterior to base of oesophagus but sharply behind vulva. Cuticle smooth, 2 um at middle and 4 um at tail. Lateral chords about 1/3rd of corresponding body-width near middle. Lip region wider than adjoining body, set off, 22 um wide and 12 um high. Amphids cup-shaped; their apertures slit-like, about 3 um wide and 12 um from anterior extremity. Buccal cavity 30 x 17 um. Apex of dorsal tooth 8 um from base of stoma; two denticles (foramina) present near base. Oesophago-intestinal junction tuberculate. Nerve ring 37% of oesophageal length from anterior end. Rectum 17 um long. Vulva transverse. Vagina sclerotized distally. Gonads amphidelphic. Uterus and oviduct separated by a weak sphincter. Tail filiform, whip-like, 355 um or about 14 anal body-widths long. Caudal glands and terminal opening present.

Habitat and locality: Soil around roots of banana, Musa pardisiaca, from Maya Bander Island, Andamans.

IOTONCHUS ANTEDONITUS HULVEY, 1963

(Plate: XXIX, Fig. 5-F)

Dimensions:

Females (3): L = 1.32-1.44 mm; a = 22-27; b = 3.7-4.0; c = 17-18; V = 64-69.

Description:

Body ventrally arcuate upon fixation. Cuticle smooth. Lip region 27-29 um wide, 9 um high. Amphid apertures 4-5 um wide, 10-11 um from anterior extremity. Buccal cavity 26-30 x 15-18 um. Apex of dorsal tooth at 20-21 um from base of buccal cavity. Subventral walls bearing two small denticles each. Oesophago-intestinal junction tuberculate. Rectum 23-26 um long. Gonads amphidelphic. Ovaries reflexed. Uterus and oviduct separated by a well developed sphincter. Tail 78-80 um, 2.3-2.5 anal body-widths long, arcuate conoid with acutely rounded terminus. Caudal glands and spinneret absent.

Habitat and locality: Soil around roots of Indian bean (Dolichos lablab) and black gram (Phaseolus mungo radiatus) from Dhaulpur, Kulu, Himachal Pradesh.

ICTONCHUS INDICUS JAIRAJPURI, 1969

Dimensions:

El Salvador onion population: Females (2): L = 1.56-1.79 mm; a = 27-28; b = 3.5-4.1; c = 5-8; V = 57-59.

El Salvador chilli pepper population: Female; L = 1.23 mm; a = 25; b = 3.7; c = 6; V = 69.

Description:

Body ventrally arcuate upon fixation. Cuticle smooth. Lip region set off, 33-42 um wide, 14-16 um high. Amphids stirrup-shaped; apertures 5-6 um wide, 12-15 um from anterior extremity. Buccal cavity 40-50 x 26-29 um. Apex of dorsal tooth 8-11 um from base of buccal cavity. Subventral walls bearing two small denticles each. Rectum 23-30 um long. Gonads amphidelphic. Ovaries reflexed. Uterus and oviduct not separated by sphincter. Tail 218-345 um, 6-9 anal body-widths long, elongate-conoid, tapering regularly, tail tip sharply conoid. Caudal glands poorly developed; opening subterminal.

Habitats and localities:

(i) Soil around roots of onion, Allium cepa, from San Jose de Las Flores, El Salvador.

(ii) Soil around roots of chili pepper, Capsicum sp., from San Jose de Las Flores, El Salvador.

ICTONCHUS PARAPARASIDORUS MULVEY AND JENSEN, 1967

(Plate: XXIX, Fig. G-i)

Dimensions:

Females (2): L = 2.34-2.73 mm; a = 30-35; b = 4.2-4.5; c = 8-9; V = 59-62.

Male: L = 2.25 mm; a = 27; b = 4.2; c = 10; T = 40

Description:

Female: Body ventrally arcuate upon fixation. Cuticle smooth. Lip region set off, 43-50 um wide, 18-20 um high. Amphid apertures 5-7 um wide, 17-19 um from anterior extremity. Buccal cavity 44-56 x 32-36 um. Dorsal tooth at 15-17 um from base of buccal cavity. Subventral walls bear two small denticles (foramina) each. Oesophago-intestinal junction tuberculate. Rectum 41-44 um long. Gonads amphidelphic, with vulval papillae anterior and poster or to vulva. Ovaries reflexed. Uterus and oviduct separated by a well developed sphincter. Tail 227-330 um, 5-7 anal body-widths long, elongate-conoid, with rounded terminus. Caudal glands present; spinneret terminal.

Male: Body ventrally curved, curvature more prominent in posterior region. Spicules 108 um long. Gubernaculum 30 um long. Lateral guiding pieces 23 um. Copulatory muscles extending up to level of the last supplement. Supplements 12, regularly spaced. Tail 229 um or about 4 anal body-widths long, elongate-conoid, ventrally curved. Caudal glands well

developed, opening terminally.

Habitat and locality: Soil around roots of grasses from Palampur, Himachal Pradesh.

HOPLOLAIMUS MULLEYI N. SP.

(Plate: XXX)

Dimensions:

Holotype female: L = 2.20 mm; a = 33; b = 4.5; c = 6; V = 56.

Description:

Body upon fixation strongly arcuate ventrally, tapering slightly anteriorly but markedly posteriorly. Cuticle smooth, 3-9 um thick. Lip region set off, distinctly wider than adjoining body, 46 um wide, 15 um high. Amphids cup-like; apertures 6 um wide, 25 um from anterior extremity. Buccal cavity 56 x 30 um. Dorsal tooth small, in posterior half of buccal cavity; its apex at 12 um from base of buccal cavity. Nerve ring at 131 um from anterior end of body. Rectum 40 um long.

Vulva transverse. Vagina thick-walled; triangular cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Each sexual branch consists of a long uterus, an oviduct with narrow distal and enlarged proximal

part, and a reflexed ovary with 11-12 oocytes. Uterus and oviduct separated by a well developed sphincter. Tail 386 um or about 9 anal body-widths long, elongate conoid, tapering regularly. Caudal glands well developed; opening terminal.

Male: Not found.

Type habitat and locality: Soil around roots of plantain, Musa paradisiaca from San Rafael Obrajuelo, EL Salvador.

Type specimens: Holotype female on slide Iotonchus mulveyi/1.

Differential diagnosis: Iotonchus mulveyi n. sp., comes close to I. basidontus Clark, 1969 but differs in having set off lip region, different dimensions of buccal cavity, and more posteriorly situated amphids.

IOTONCHUS COOMANSI N. SP.

(Plate: XVVI)

Dimensions:

Paratype females (5): L = 0.69-0.80 mm; a = 18-20; b = 3.1-3.4; c = 13-17; V = 56-65.

Holotype female: L = 0.76 mm; a = 19; b = 3.2; c = 17; V = 66.

Description:

Body ventrally arcuate upon fixation, tapering slightly anteriorly but markedly towards posterior end. Cuticle smooth, 2-4 um thick. Lip region set off from body, 18 um wide, 7-8 um high. Amphids large, stirrup-shaped; apertures 5 um wide, 9-11 um from anterior extremity. Buccal cavity 21-23 x 11-12 um. Dorsal tooth large in the anterior half of buccal cavity; its apex at 13-14 um from base of buccal cavity. Nerve ring at 75-85 um from anterior end of body. Rectum 18-23 um long.

Vulva transverse. Vagina short; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries consisting of 12-16 oocytes arranged in multiple rows. Uterus and oviduct separated by sphincter; Tail 45-57 um, 2.0-2.5 anal body-widths long, conoid with rounded terminus, ventrally arcuate. Caudal glands and spinneret absent.

Male: Not found.

Type habitat and locality: Collected in The Netherlands, exact habitat and locality not known. The specimens were obtained through the courtesy of Prof. A. Coomans.

Type specimens: Holotype on slide Iotonchus coomansi/1; paratypes on slide Iotonchus coomansi/2.

Differential diagnosis: Iotonchus coomansi n. sp., comes close to Iotonchus antedontus Mulvey, 1963 but differs from it in having a shorter body (L = 1.2-1.5 mm in I. antedontus), in the shape and size of buccal cavity (buccal cavity 25-29 x 16-18 um in I. antedontus), larger dorsal tooth, more posterirly situated and differently shaped amphids, and also in the shape and length of tail.

IOTONCHUS PARAANTEDONTUS N. SP.

(Plate: XXXII)

Dimensions:

Sultanpur population (type population): Holotype female: L = 1.39 mm; a = 28; b = 3.9; c = 20; V = 67.

Nagpur population: Female: L = 1.33 mm; a = 24; b = 4.0; c = 18; V = 71.

Akhara Bazar population: Female: L = 1.34 mm; a = 22; b = 3.7; c = 18; V = 74.

Dhaulpur population: Female: L = 1.42 mm; a = 22; b = 3.0; c = 18; V = 67.

Description:

Body ventrally arcuate upon fixation, tapering slightly anterior to base of oesophagus and towards posterior end. Cuticle smooth, 3-5 um thick. Lip region setoff,

29-32 um wide, 9-13 um high. Amphids large, stirrup shaped; apertures 4-5 um wide, 9-13 um from anterior extremity. Buccal cavity 32-36 x 18-24 um. Dorsal tooth in the anterior half of buccal cavity, its apex at 20-21 um from base of buccal cavity. Oesophago-intestinal junction tuberculate. Nerve ring at 110-119 um from anterior end of body. Rectum 23-28 um long.

Vulva transverse. Vagina short; cuticularized pieces present at vulva-vagina junction. Gonads amphidelphic. Ovaries reflexed with 10-13 oocytes. Uterus and oviduct separated by a well developed sphincter. Tail 69-88 um, 2.0-2.5 anal body-widths long, conoid, ventrally arcuate with actue terminus. Caudal glands and spinneret absent.

Male: Not found.

Type Habitat and locality: Soil around roots of apple, Pyrus malus, from Sultanpur, Kulu, Himachal Pradesh.

Other localities:

(i) Soil around roots of deodar Cedrus deodara from Naggar, Himachal Pradesh.

(ii) Soil around roots of apple, Pyrus malus, from Akhara Bazar, Kulu, Himachal Pradesh.

(iii) Soil around roots of maize, Zea mays and lady finger, Abelmoschus esculentus , from Dhaulpur, Kulu, Himachal Pradesh.

Type specimen: Collected in October, 1970 by Dr. M. S. Jairajpuri; mounted on slide Iotonchus paraantedontus/1. Other specimens on slides Iotonchus paraantedontus/2-4.

Differential diagnosis: Iotonchus paraantedontus n. sp., comes close to I. antedontus Mulvey, 1963 and I. coomansi n. sp. From the former it differs in shape and dimensions of buccal cavity (buccal cavity 25-29 x 16-18 um in I. antedontus); differently shaped amphids; and more arcuate tail. From I. coomansi it differs in having longer body (L = 0.69-0.80 mm in I. coomansi); more anteriorly situated dorsal tooth apex (dorsal tooth apex 13-14 um in I. coomansi); different dimensions of buccal cavity (buccal cavity 21-23 x 11-12 um in I. coomansi); and tail with acute rounded terminus (tail with rounded terminus in I. coomansi).

IOTONCHUS DASHWOODI N. SP.

(Plate: XXXIII, Fig.A-E)

Dimensions:

Haldwani population: (type population): Paratype female: L = 1.32 mm; a = 45; b = 4.0; c = 4.0; V = 61.

Holotype female: L = 1.30 mm; a = 40; b = 4.4; c = 4.1; V = 62.

Reang population: Female: L = 1.16 mm; a = 33; b = 4.0; c = 4.1; V = 61.

Description:

Body upon fixation ventrally curved in posterior half, tapering slightly anterior to base of oesophagus, but sharply towards posterior end. Cuticle smooth, 2 um at middle and 3-4 um at tail. Lateral chords 1/4th-1/3rd of body-width near middle. Lip region set off by a constriction, 21 um wide and 9-11 um high. Amphids small, cup-shaped; their apertures slit-like, about 3 um wide and 9-11 um from anterior extremity. Sensillar pouches 8-9 um from amphidial slits. Buccal cavity 23-24 x 12-15 um, cylindrical. The female from Reang has a narrower buccal cavity (Fig. B). Apex of dorsal tooth 16-17 um from base of stoma or in anterior third of buccal cavity. Oesophago-intestinal junction tuberculate. Nerve ring 88-98 um from anterior end. Rectum 15-20 um long.

Vulva transverse. Vulval papillae not seen. Vagina sclerotized distally. Gonad mono-prodelphic. Uterus and oviduct separated by a well developed sphincter. Ovary reflexed. Sperm not seen. Tail long, filiform, 283-312 um or 14-19 anal body-widths long, or 24-25% of body length. Caudal glands and subterminal opening present.

Male: Not found.

Type habitat and locality:

(i) Soil around roots of maize Zea mays from Haldwani, District Nainital, Uttar Pradesh.

(ii) Reang population: Soil around roots of banana, Musa paradisiaca, from Reang, Testa, District Darjeeling, West Bengal.

Type specimens: Holotype female along with paratype female mounted on slide Iotonchus maghhoodi/1. Specimen from Reang on slide Iotonchus maghhoodi/2.

Differential diagnosis: Iotonchus maghhoodi n. sp. in having a "whip-like" tail or more than 24% of body length comes close to I. trichurus (Cobb, 1917) Andrassy, 1958 and I. chantaburensis Buangsuwon and Jensen, 1966. From the former it differs in having apex of dorsal tooth at anterior third of buccal cavity (apex of dorsal tooth nearly basal in I. trichurus), uterus and oviduct separated by a well developed sphincter (sphincter either absent or weak in I. trichurus) and opening of caudal glands subterminal (opening of caudal glands terminal in I. trichurus). From I. chantaburensis it differs in having apex of dorsal tooth at anterior third of buccal cavity (apex of dorsal tooth nearly basal in I. chantaburensis), and in having a differently shaped tail.

IOTONCHUS LONGICAUDATUS N. SP.

(Plate: XXXIII, Fig. F-I)

Dimensions:

Paratype female: L = 1.18 mm; a = 39; b = 3.5; c = 3.5; V = 59.

Holotype female: L = 1.08 mm; a = 41; b = 4.2; c = 3.4; V = 60.

Description:

Body upon fixation ventrally curved in posterior half, tapering slightly anterior to base of oesophagus but markedly at posterior end. Cuticle smooth, 1-2 um thick (thickest on tail). Lateral chords about 1/4th of body-width near middle. Lip region set off, wider than adjoining body, 17 um wide and 8-9 um high. Amphids small, cup-shaped; their apertures 3-4 um wide and 8-9 um from anterior extremity. Senaillar pouches 10-11 um from amphidial slits. Buccal cavity cylindrical, 21-22 x 12 um. Apex of dorsal tooth 11 um from base of stoma or near middle of buccal cavity. Oesophago-intestinal junction tuberculate. Nerve ring 88-90 um from anterior end. Rectum 14 um long.

Vulva transverse. Vagina sclerotized distally. Gonad mono-prodelphic. Uterus and oviduct separated by weak sphincter. Ovary reflexed. Sperms not seen. Tail long,

filiform, 295-334 um or 17-19 anal body-widths long or 27-28% of body length. Caudal glands and subterminal opening present.

Male: Not found.

Type habitat and locality: Soil around roots of tea, Camellia sinensis, from Dehradun, Uttar Pradesh.

Type specimens: Collected by Mr. Wahid Husain; holotype along with paratype female mounted on slide I. longicaudatus/1.

Differential diagnosis: Iotonchus longicaudatus n. sp. comes close to I. trichurus (Cobb, 1917) Andrassy, 1958, and I. mashhoodi n. sp. From the former it differs in having smaller body length (L = 1.2-1.6 mm in I. trichurus), apex of dorsal tooth near middle of buccal cavity (apex of dorsal tooth nearly basal in I. trichurus) and subterminal opening of caudal glands (opening of caudal glands terminal in I. trichurus). From I. mashhoodi it differs in having apex of dorsal tooth near middle (apex of dorsal tooth at anterior third of buccal cavity in I. mashhoodi), thinner cuticle (cutile 2-4 um thick in. I. mashhoodi) and differently shaped lip region.

KEY TO SPECIES OF *ICOTONCHUS*

(Modified after Jairajpuri, 1969)

1. Female monodelphic 2
   Female didelphic 15
2. Cuticularized pieces in vagina, 9-12 um from vulva .....
   ..... *bagrii* Jairajpuri, 1969
   Cuticularized pieces at vulva-vagina junction 3
3. Tail length 23-35% of body length 4
   Tail length 6-17% of body length 8
4. Apex of dorsal tooth located at anterior third of buccal cavity ..... *maghhoodi* n. sp.
   Apex of dorsal tooth located posterior to middle in buccal cavity 5
5. Tail tip expanded .....
   ..... *bangkokensis* Ruangsuwon & Jensen, 1966
   Tail tip not expanded 6
6. Tail conoid then cylindroid, ventrally hooked .....
   ..... *chantaburensis* Ruangsuwon & Jensen, 1966
   Tail long filiform, "whip-like" 7
7. Apex of dorsal tooth at 50% from base of stoma; opening of caudal glands subterminal ..... *longicaudatus* n. sp.
   Apex of dorsal tooth less than 30% from base of stoma; opening of caudal glands terminal .....
   ..... *trichurus* (Cobb, 1917) Andrassy, 1958

8. Dorsal tooth at middle or anterior to middle of buccal cavity 9

Dorsal tooth nearly basal in buccal cavity 10

9. Dorsal tooth opposed by a minute tooth-like projection.. ..... (Cobb,1917) Jairajpuri, 1970

Dorsal tooth not opposed by such a tooth ....jairi (Lordello, 1958) Clark, 1960

10. Caudal glands and terminal opening absent ....nigeriensis Mulvey & Jensen, 1967

Caudal glands and terminal or subterminal opening present 11

11. Opening of caudal glands subterminal .... acuticaudatus Mulvey & Jensen, 1967

Opening of caudal glands terminal 12

12. Tail terminus distinctly expanded 13

Tail terminus not expanded 14

13. Length 2.9 mm; buccal cavity 50 x 40 um, walls transversely striated .... gymnolaimus (Cobb, 1893) Andrassy, 1958

Length 1.2-1.3 mm; buccal cavity 34-36 x 19 um, walls not transversely striated ..... microdontus Thong, 1970

14. Length 1.72 mm; tail about 7% of body length .... ainostomos Buangsuwon & Jensen, 1966

Length 2.8-3.5 mm; tail about 14% of body length .... consimilis (Cobb, 1917) Andrassy, 1958

15. Tail extremely short, hemispheoid or rounded 16

Tail long, conoid, elongate-conoid or filiform 17

16. Length 0.5-0.9 mm; dorsal tooth in anterior third .....
..... ovatus Jansen & Mulvey, 1968
Length 4.18 mm; dorsal tooth in posterior third .....
..... magyar Andrassy, 1973

17. Dorsal tooth apex situated in anterior third of buccal cavity 18
Dorsal tooth apex situated in posterior third of buccal cavity 21

18. Tail relatively long, more than 150 um (c=below 43) .....
.... vorax (Cobb, 1917) Mulvey, 1963
Tail relatively short, below 100 um (c=more than 13) ...
.... 19

19. Body length 0.69-0.80 mm; tail with broadly rounded terminus ..... coomansi n. sp.
Body length 1.2-1.5 mm; tail with acutely rounded terminus 20

20. Buccal cavity 25-25 18 um ....
..... antedontus Mulvey, 1963
Buccal cavity 32-36 x 9-13 um..... paraantedontus n. sp.

21. Tail long to very long, 10% or more of body length .....
..... 22
Tail relatively short, 10% or less of body length .....
..... 37

22. Tail extremely attenuated, 'whip-like', about 34% of body length ..... maragnus Clark, 1960

Tail filiform or conoid-cylindroid, 30% or less of body length 23

23. Dorsal tooth apex situated nearly midway from base of buccal cavity..... orhiocercus Clark, 1960

Dorsal tooth apex situated in posterior third of buccal cavity 24

24. Tail filiform ..... percivali Clark, 1960

Tail conoid then cylindroid to terminus 25

25. Caudal glands absent 26

Caudal glands present 28

26. Lateral organs near vulva present .....
..... transkiensis Heyns & Largeway, 1965

Lateral organs absent 27

27. Buccal cavity 34 x 22 um; tail length avg. 250 um .....
..... thailandensis Buangsuwon & Jensen, 1966

Buccal cavity 40-43 x 23-29 um; tail length avg. 350 um.
..... clarki Mulvey & Jensen, 1967

28. Buccal cavity barrel-shaped, about one and half times as long as wide 29

Buccal cavity rectangular in shape, about twice as long as wide 30

29. Tail duct terminal ....
..... riocoeiae (Carvalho, 1955) Andrassy, 1958

Tail duct subterminal ..... indicus Jairajpuri, 1969

30. Terminal opening to caudal glands absent 31

Terminal opening to caudal glands present 32

31. Sphincter present at oviduct-uterus junction; c=6-13.... ..... spinicaudatus Coetzee, 1967

Sphincter not present at oviduct-uterus junction c=3-4.. .....tarjani Mulvey & Jensen, 1967

32. Tail duct opening subterminal 33

Tail duct opening terminal 34

33. Sphincter present at oviduct-uterus junction .... tenuidentatus (Dreis, 1924) Mulvey, 1963

Sphincter not present at oviduct-uterus junction .... rayongensis Buangsuwon & Jensen, 1966

34. Tails 18-27% of body length, tail conoid one half distance posterior to anus then cylindroid to terminus .... vulvapapillatus Andrassy, 1964

Tails 11-15% of body length, tail conoid two-thirds distance posterior to anus then cylindroid to terminus 35

35. Vulval papillae generally well developed .... parabasidontus Mulvey & Jensen, 1967

Vulval papillae absent 36

36. Lip region scarcely set off, amphid apertures slightly less than one half head-width from anterior extremity... .... basidontus Clark, 1960

Lip region set off, amphid apertures about two-third head-width from anterior extremity....*mulveyi* n. sp.

37. Caudal glands present 38
Caudal glands absent 42

38. Buccal cavity barrel-shaped, nearly as wide as long.. ..... *brachylaimus* (Cobb, 1917) Andrassy, 1958
Buccal cavity rectangular, about twice as long as wide 39

39. Tail relatively short (c=31-37), about 3% of body length.....*simmenensis* (Kreis, 1924) Andrassy, 1958
Tail relatively long (c=12-15) about 7-8% of body length 40

40. Body length 2-3 mm; lip region slightly set off from body ..... *aranicola* Altherr, 1963
Body length 1.5-2.1 mm; lip region distinctly set off from body 41

41. Tail about 2-3 anal body-widths long .... *geminus* Heyns Lagerwey, 1965
Tail about 3-4 anal body-widths long .... *rinae* Coetzee, 1967

42. Dorsal tooth nearly basal in buccal cavity 43
Dorsal tooth forward of posterior third in buccal cavity 45

43. Vagina with sclerotized pieces 44
Vagina without sclerotized pieces .... *pauli* Heyns & Lagerwey, 1965

44. Tail very short with blunt tip .. ..
.. .. laticupulatus Rizzhivin, 1971

Tail relatively long with pointed tip .....
..... acutus (Cobb, 1917) Andrassy, 1958

45. Tail relatively long, about 8% of body length .....
..... paraschokkai (Allgen, 1929) Andrassy, 1958

Tail relatively short, less than 5% of body length .....
..... 46

46. Male with 12 or less supplements .....
..... amphigonicus (Thorne, 1924) Andrassy, 1958

Male with 20 or more supplements .....
..... eschokkai (Menzel, 1913) Altherr, 1955

NOT INCLUDED IN THE KEY

Iotonchus litoralis Coetzee, 1967 which is regarded a synonym of I. risoceiae (Heyns, in litt., communicating the views of Dr. Coetzee).

Iotonchus antedontoides Coetzee, 1967: According to Jairajpuri (1970) the validity of I. antedontoides is questionable and most probably it is a synonym of I. monhystera (Cobb, 1917) Jairajpuri, 1970.

While the thesis was being typed, a paper by Eroshenko (1975) was broughtto my notice. Since the paper is in Russian, it could not be translated in short time. Eroshenko has described five new species of Iotonchus in this paper. As inferred from the illustrations, these species differ from other species of the genus as follows:

1. Iotonchus cobbi Eroshenko, 1975 differs from I.zschokkei (Menzel, 1913) Altherr, 1955 in having longer tail (c=15-19 against 20-24 in I.zschokkei); longer spicules (126 um against 95 um in I. zschokkei); and in longer and differently shaped gubernaculum (42 um against 30 um in I. zschokkei).

2. Iotonchus monticola Eroshenko, 1975 differs from I. zschokkei in having longer spicules (110 um against 95 um in I. zschokkei); and differently shaped gubernaculum. Iotonchus monticola also differs from I. cobbi in having different dimensions of buccal cavity (70-75 x 39-40 um against 56 x 30 um in I. cobbi); shorter spicules (110 um against 126 um in I. cobbi); and in shorter gubernaculum (32 um against 42 um in I. cobbi).

3. Iotonchus paraamphigonicus Eroshenko, 1975 differs from I. amphigonicus (Thorne, 1924) Andrassy, 1958 in having longer oesophagus (b = 3.2-3.5 against 4.8-5.0 in I. amphigonicus).

4. Iotonchus acuticaudatus Eroshenko, 1975 differs from I. amphigonicus in having longer oesophagus (b = 3.2 against

4.8-5.0 in I. amphigonicus); and in the presence of vulval papillae and caudal glands. In the latter character it also differs from I. paraamphigonicus.

5. Iotonchus mucronatus Eroshenko, 1975 differs from I. monticola in having differently shaped amphids; vagina with heavily sclerotized pieces; and in the shape of female tail.

GENUS HADRONCHUS MULVEY AND JENSEN, 1967

Diagnosis: Labial region set off from body, buccal cavity longer than wide, walls thick. Dorsal tooth variable in position, opposed by low longitudinal rows of few to numerous denticles on vertical subventral walls. Oesophago-intestinal junction tuberculate. Females amphidelphic or mono-prodelphic, with or without a posterior uterine sac. Vulval papillae present or absent. Tail elongate-conoid to long, filiform with or without caudal glands and terminal opening. Spicules large, stout, with bifurcated lateral accessory pieces.

Type species: Hadronchus bisexualis Mulvey and Jensen, 1967

Jairajpuri (1969) while describing the new species H. andamanicus and H. shakili observed that the Indian species differ from the other two known Nigerian species, i.e., H. bisexualis and H. monohystera described by Mulvey and Jensen (1967), in having the following characters: Dorsal tooth situated in posterior half of buccal cavity opposed by a lesser number of denticles, gonads amphidelphic or mono-prodelphic with large posterior uterine sac carrying rudiments of the lost ovary, vulval papillae present, tail long and filiform with distinct caudal glands and terminal opening. Jairajpuri (l.c.) considered all these differences to be of specific value. The present author feels that the genus Hadronchus may further be splitted on the basis of the above

mentioned differences to accommodate the Indian species. At the same time it is felt that the proposal of a new genus may only be justified provided some more species are described under the group of Indian species. Since the author has found only one population of H. shakili, the view to split the genus Hadronchus has been reserved.

HADRONCHUS SHAKILI JAIRAJPURI, 1969

(Plate: XXXIV)

Dimensions:

Females (3): L = 3.01-3.30 mm; a = 40-45; b = 4.7-4.8; c = 5-6; V = 56-58.

Males (4): L = 2.66-2.92 mm; a = 45-48; b = 4.8-5.3; c = 5-7; T = 44-65.

Description:

Female: Body almost straight in anterior half but becomes ventrally curved in posterior half upon fixation, tapering slightly at anterior end but markedly posteriorly. Cuticle smooth, 2-8 um thick (thickest on tail). Lateral chords 1/8th-1/6th of body-width near middle. Amphidial apertures 6-7 um wide and 15-17 um from anterior end. Lip region set off, wider than adjoining body, 37-40 um wide and 15-17 um high. Buccal cavity 50-53 x 31-33 um. Apex of dorsal

tooth 22-25 um from base of stoma. The vertical subventral walls of buccal cavity bear 3-5 teeth, spaced closely. Oesophago-intestinal junction tuberculate. Nerve ring 168-180 um from anterior end. Rectum 22-26 um long.

Vulva transverse. Two pre- and two post-vulval papillae present. Vagina sclerotized distally, extending inward 16-20 um. Gonads amphidelphic. Uterus and oviduct separated by a well developed sphincter. Ovaries reflexed. Tail long, 475-569 um or 10-11 anal body-widths long. Caudal glands well developed and terminal opening present.

Male: Body strongly curved in posterior third. Buccal cavity 41-46 x 27-29 um. Apex of dorsal tooth 17-20 um from base of stoma. Sperm spindle-shaped. Ejaculatory glands visible. Spicules 68-80 um long medially. Gubernaculum 18-22 um long and lateral accessory pieces 11-15 um. Supplements 11-13 in number. Tail long, 414-496 um.

Habitat and locality: Soil around roots of Mango, Mangifera indica, from Bilaspur, District Rampur, Uttar Pradesh.

SUBORDER BATHYODONTINA COOMANS AND LOOF 1970

SUPERFAMILY MONONCHULOIDEA (DE CONINCK, 1965) COOMANS & LOOF, 1970

FAMILY MONONCHULIDAE (DE CONINCK, 1965) JAIRAJPURI, 1969

GENUS MONONCHULUS COBB, 1918

Diagnosis: Mononchulidae. Stoma long, cylindrical, thick-walled; with three teeth, of which subventral one is large and grooved; with six rows of denticles. DN at level of S_1 N; S_2 N at about same level or even below S_2O. Oesophago-intestinal junction with three cardiac glands. Gonad monoprodelphic. Tail long, cylindrical; caudal glands present; spinneret conspicuous.

Type species: Mononchulus nodicaudatus (v. Daday, 1901) Schneider, 1937

Cobb (1918) proposed this genus, with a single species M. ventralis Cobb, 1918, but Schneider (1937) synonymized this species with Prismatolaimus nodicaudatus v. Daday, 1901. A soil sample received from Karimganj, Assam yielded 9 females of M. nodicaudatus. This species is being reported for the first time from India.

MONONCHULUS NODICAUDATUS (v. DADAY, 1901) SCHNEIDER, 1937

(Plate: XXXV)

Dimensions:

Females (9): L = 1.01-1.21 mm; a = 25-34; b = 4.0-4.2; c = 10-11; V = 61-64.

Description:

Body almost straight or slightly curved ventrally, tapering slightly towards both extremities. Cuticle smooth, 2-5 um thick (thickest on tail). Lateral chords cellular, cells arranged longitudinally in three rows, about 1/4th of body-width near middle. Lip region almost continuous, 12-14 um wide and 6-8 um high. Amphids cup-shaped, apertures about 3 um wide and 6-8 um from anterior end. Stoma 22-24 x 8 um, embedded in oesophageal tissue up to about the base of main tooth. Opposite the base of main tooth there are two small teeth which are slightly behind one another; six rows of denticles present at the level of subventral tooth. Oesophago-intestinal junction with cardiac glands. Nerve ring 82-93 um from anterior end. Rectum 19-24 um long.

Vagina moderately sclerotized. Gonad mono-prodelphic; posterior uterine sac absent. Uterus and oviduct separated by a weak sphincter. Oocytes arranged in a single row except in the growth zone. Tail long, cylindrical 92-113 um or about 3-4 anal body-widths long. Caudal glands present;

spinneret conspicuous.

Habitat and locality: Soil around roots of paddy, Oryza sativa, from Karimganj, Assam

Remarks: The present specimens agree with the description of M. ventralis as given by Cobb. The only difference being the absence of a small posterior uterine sac.

SUMMARY

The present work deals with the morphology and taxonomy of the nematodes of the Order Mononchida Jairajpuri, 1969. An outline classification of the group, diagnoses of taxa up to subfamily and a key up to genera of Mononchida has been given. An attempt has been made to provide information about the locations of oesophageal gland nuclei and their orifices in 18 species of mononchs. In all 41 species of the suborder Mononchina and Mononchulus nodicaudatus belonging to the suborder Bathyodontina have been described from specimens collected in India, El Salvador, The Netherlands, Poland etc. Of these, 17 species are new to science, and three of the known species are first records from India. The genus Cobbonchus which is represented by a new species is reported for the first time from India. All those species belong to 10 known and two new genera, five subfamilies, six families, and three superfamilies of Mononchida. The intra-specific variations of two closely related species, viz., Mononchus truncatus and M. aquaticus have been studied in detail based on material from several localities. Identification keys to the species of the genera Mylonchulus and Iotonchus have been provided.

I. The Suborders:

1. Mononchina
2. Bathyodontina

II. The Superfamilies:

1. Mononchoidea
2. Anatonchoidea
3. Mononchuloidea

III. The families:

1. Mononchidae
2. Mylonchulidae
3. Cobbonchidae
4. Anatonchidae
5. Iotonchidae
6. Mononchulidae

IV. The subfamilies:

1. Mononchinae
2. Prionchulinae
3. Mylonchulinae
4. Anatonchinae
5. Miconchinae

V. The known genera:

1. Mononchus
2. Prionchulus
3. Clarkus
4. Mylonchulus
5. Cobbonchus
6. Anatonchus
7. Miconchus
8. Iotonchus
9. Hadronchus
10. Mononchulus

VI. The new genera:

1. Actus
2. Paracrassibucca

VII. Identification keys:

1. Key to Order Mononchida up to genera
2. Key to species of Mylonchulus
3. Key to species of Iotonchus

VIII. The known species:

1. Mononchus truncatus
2. Mononchus aquaticus
3. Mononchus niddensis
4. Clarkus papillatus
5. Clarkus propapillatus
6. Clarkus sheri
7. Prionchulus muscorum
8. Prionchulus longus
9. Mylonchulus striatus
10. Mylonchulus agriculturae
11. Mylonchulus brachyuris
12. Mylonchulus incurvus
13. Mylonchulus index
14. Mylonchulus mulveyi
15. Mylonchulus lacustris
16. Mylonchulus nainitalens
17. Mylonchulus hawaiiensis
18. Miconchus thornei
19. Miconchus pararapax
20. Iotonchus trichurus
21. Iotonchus antedontus
22. Iotonchus indicus
23. Iotonchus parabasidontus
24. Hadronchus shakili
25. Mononchulus nodicaudatus

IX. The new species:

1. Actus salvadoricus
2. Mylonchulus clavatus
3. Mylonchulus jamili
4. Mylonchulus aquaticus
5. Mylonchulus andrassyi
6. Mylonchulus modestus
7. Mylonchulus khorai
8. Cobbonchus parabulbosu
9. Anatonchus adami
10. Anatonchus nadiri

11. Miconchus novus
12. Paracrassibucca jensoni
13. Iotonchus mulveyi
14. Iotonchus cocmansi
15. Iotonchus paraantedontus
16. Iotonchus maghhoodi
17. Iotonchus longicaudatus

X. The new combination:

1. Actus minutus

XI. First records from India

Genus - Cobbonchus

Species - Iotonchus antedontus
Iotonchus parabasidontus
Mononchulus nodicaudatus

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PLATE I

Figs. A - L Buccal cavities.

A - Mononchus

B - Clarkus

C - Prionchulus

D - Mylonchulus

E - Polyonchulus

F - Sporonchulus

G - Granonchulus

H - Prionchuloides

I - Cobbonchus

J - Anatonchus

K - Hadronchus

L - Miconchus

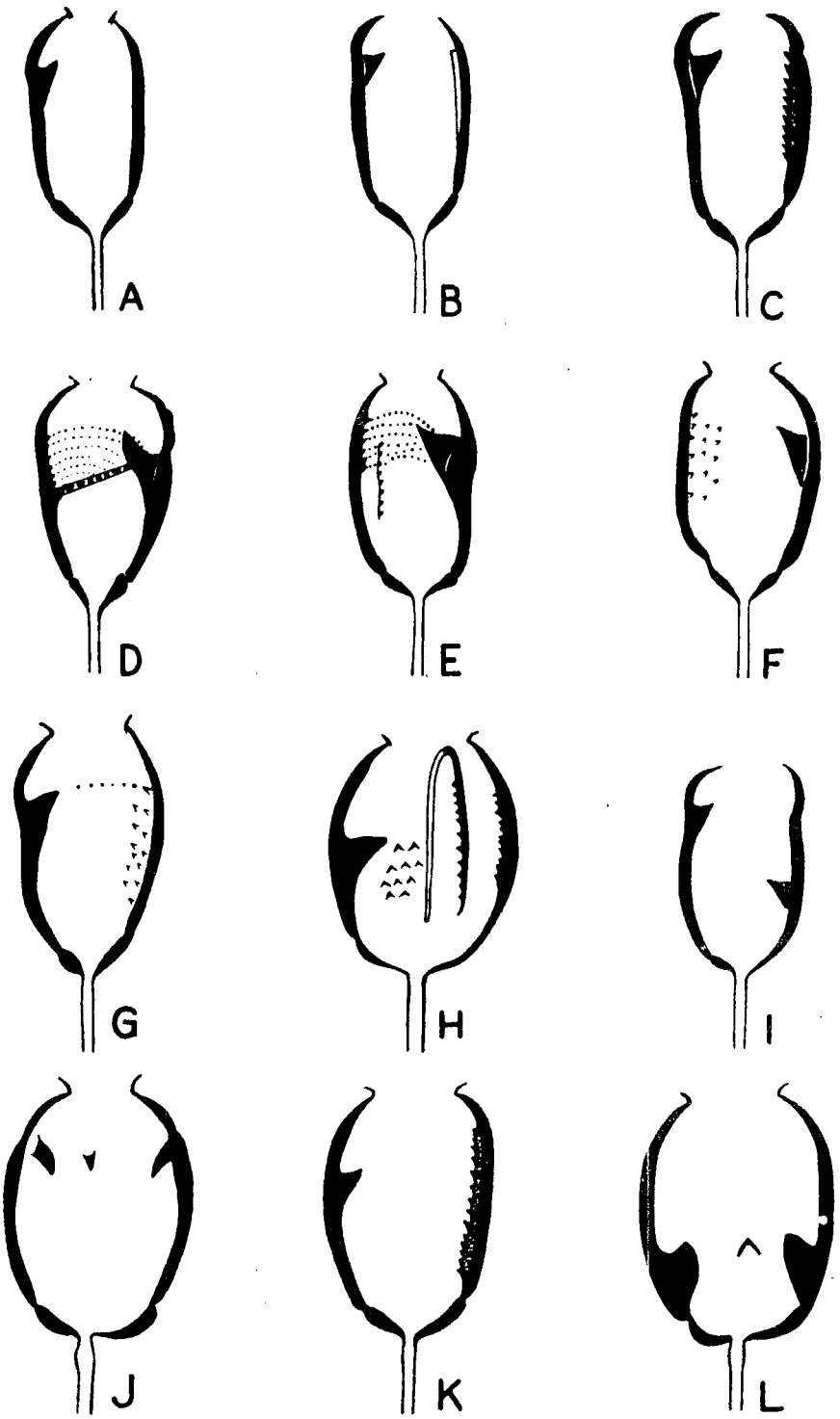

A
B
C
D
E
F
G
H
I
J
K
L

PLATE II

Figs. M - X Buccal cavities

M - *Crassibucca*

N - *Iotonchus*

O - *Iotonchus*

P - *Prionchulellus*

Q - *Actus*

R - *Paracrassibucca*

S - *Brachonchulus*

T - *Judonchulus*

U - *Mononchulus*

V - *Oionchus*

W - *Bathyodontus*

X - *Tigronchus*

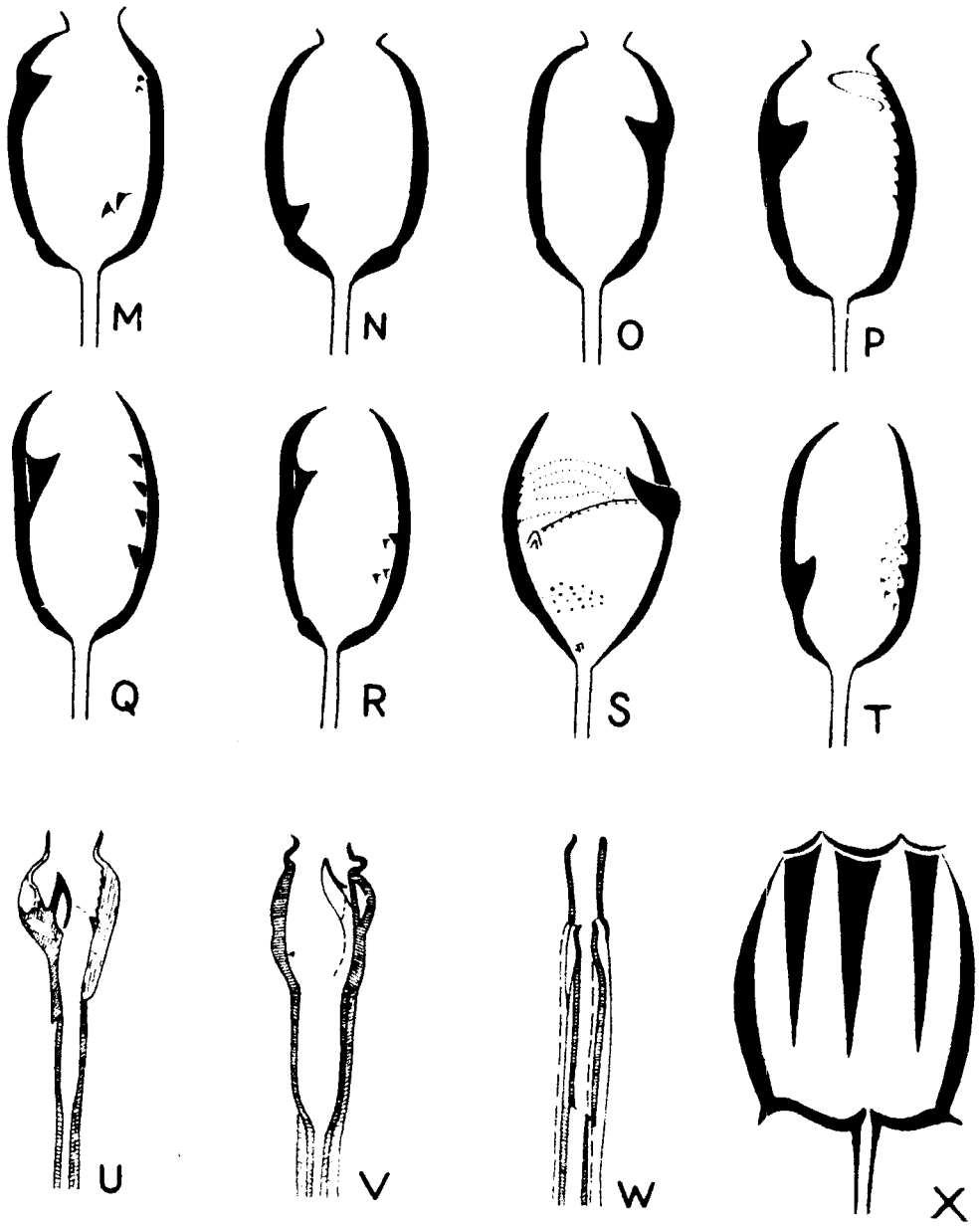

M
N
O
P
Q
R
S
T
U
V
W
X

PLATE III

Oesophageal gland nuclei and their orifices

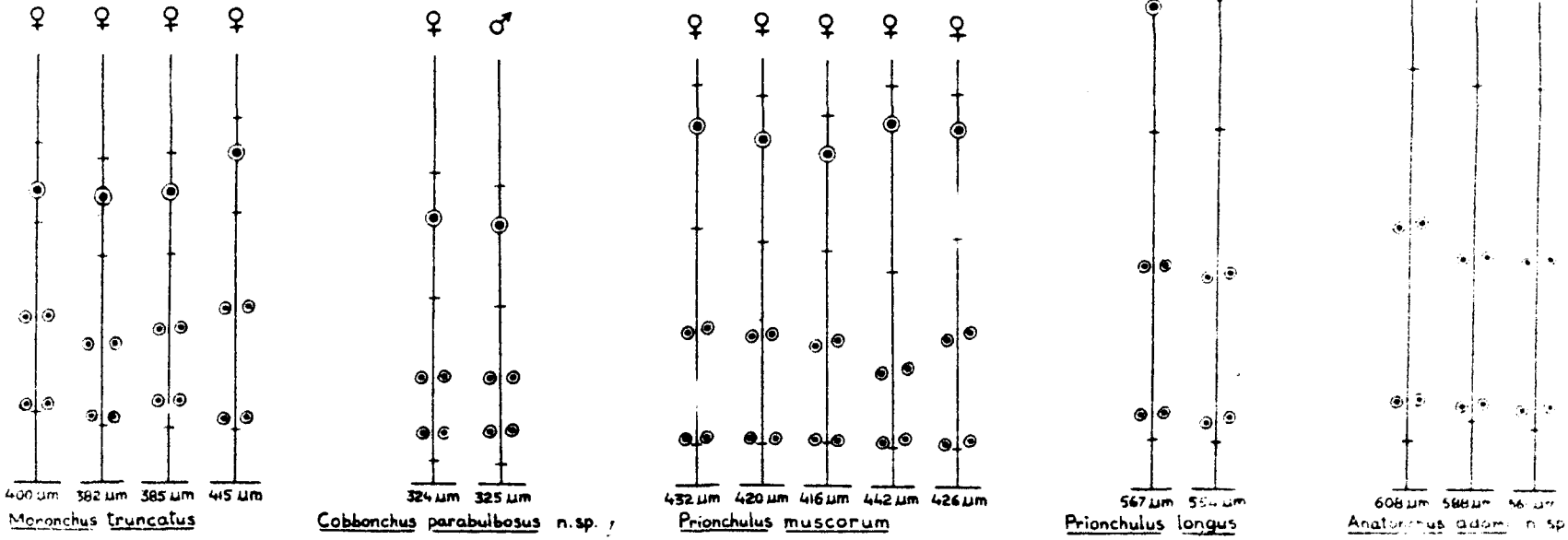

♀ ♀ ♀ ♀
400 µm 382 µm 385 µm 415 µm
Mononchus truncatus
♀ ♂
324 µm 325 µm
Cobbonchus parabulbosus n.sp.
♀ ♀ ♀ ♀ ♀
432 µm 420 µm 416 µm 442 µm 426 µm
Prionchulus muscorum
♀ ♀
567 µm
Prionchulus longus
♀ ♀ ♂
608 µm
Anatonchus

PLATE IV

Oesophageal gland nuclei and their orifices

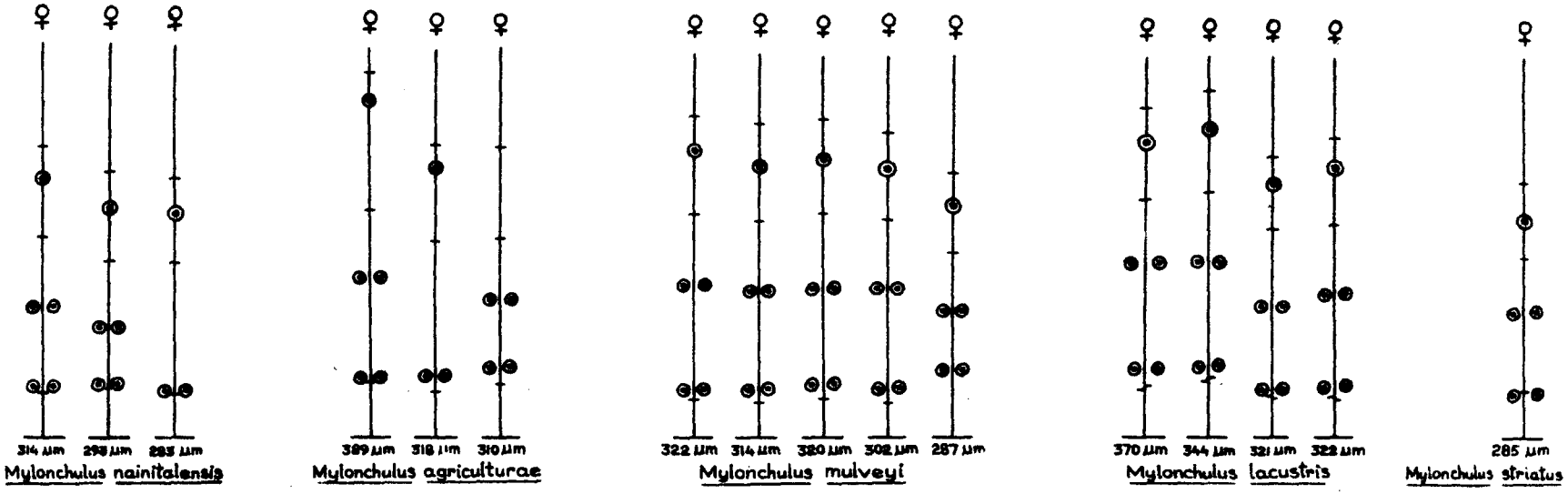

314 µm
298 µm
283 µm
Mylonchulus nainitalensis
389 µm
318 µm
310 µm
Mylonchulus agriculturae
322 µm
314 µm
320 µm
302 µm
287 µm
Mylonchulus mulveyi
370 µm
344 µm
321 µm
322 µm
Mylonchulus lacustris
285 µm
Mylonchulus striatus

PLATE V

Oesophageal gland nuclei and their orifices

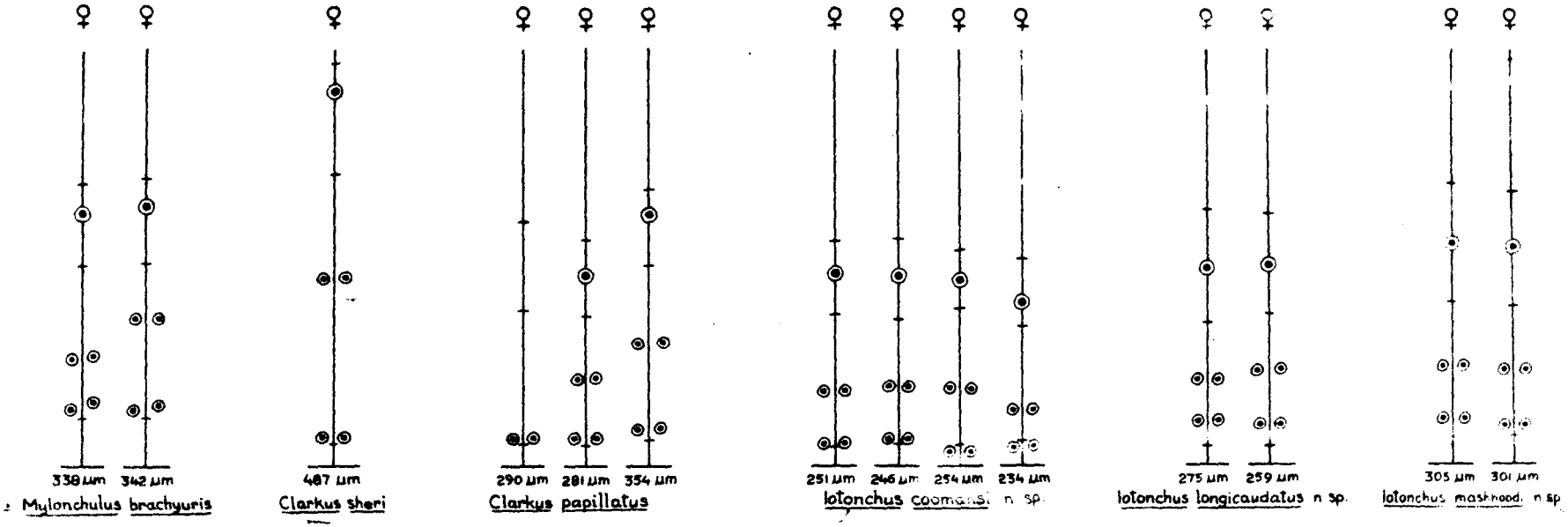
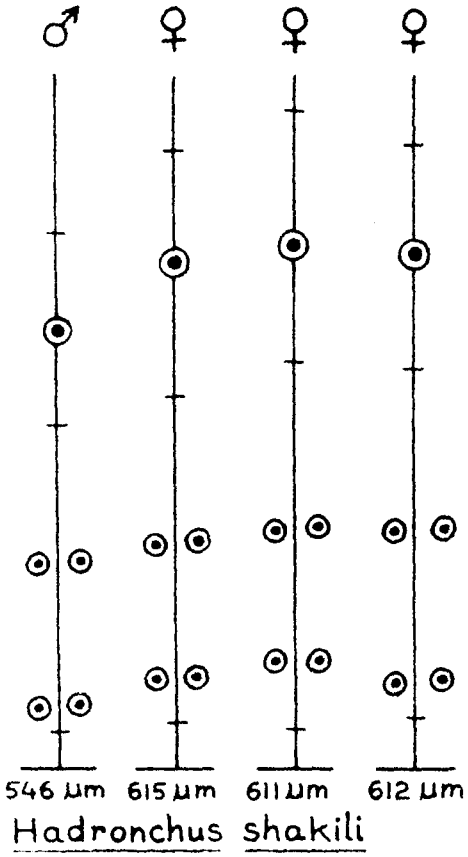

♀ ♀
338 µm 342 µm
Mylonchulus brachyuris
♀
487 µm
Clarkus sheri
♀ ♀ ♀
290 µm 281 µm 354 µm
Clarkus papillatus
♀ ♀ ♀ ♀
251 µm 246 µm 254 µm 234 µm
Iotonchus coomansi n sp.
♀ ♀
275 µm 259 µm
Iotonchus longicaudatus n sp.
♀ ♀
305 µm 301 µm
Iotonchus mashhood. n sp.

PLATE VI

Oesophageal gland nuclei and their orifices


♂
♀
♀
♀
546 µm
615 µm
611 µm
612 µm
Hadronchus shakili

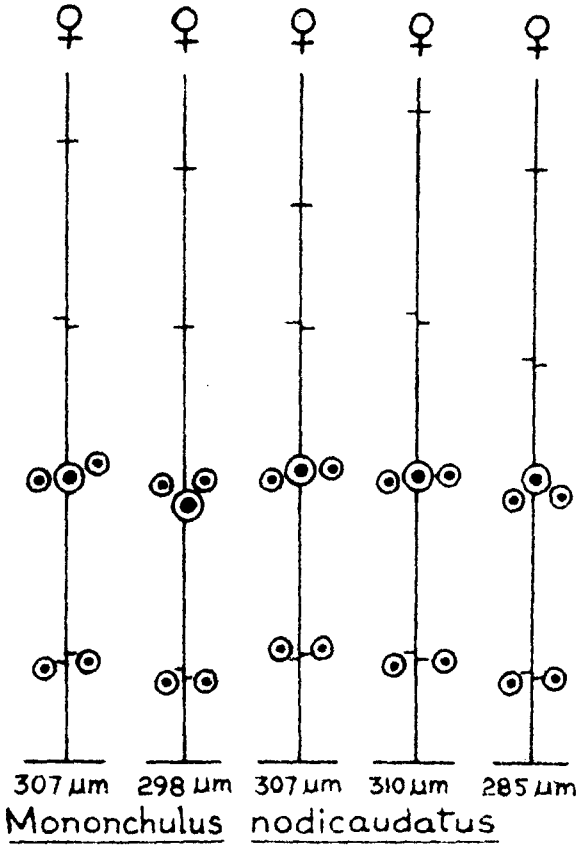

♀
♀
♀
♀
♀
307 µm
298 µm
307 µm
310 µm
285 µm
Mononchulus nodicaudatus

PLATE VII

Figs. A - E — Monocystis structures

A - Anterior end

B - Oesophago-intestinal junction

C - Seminal branches

D - Vulval region

E - Posterior end.

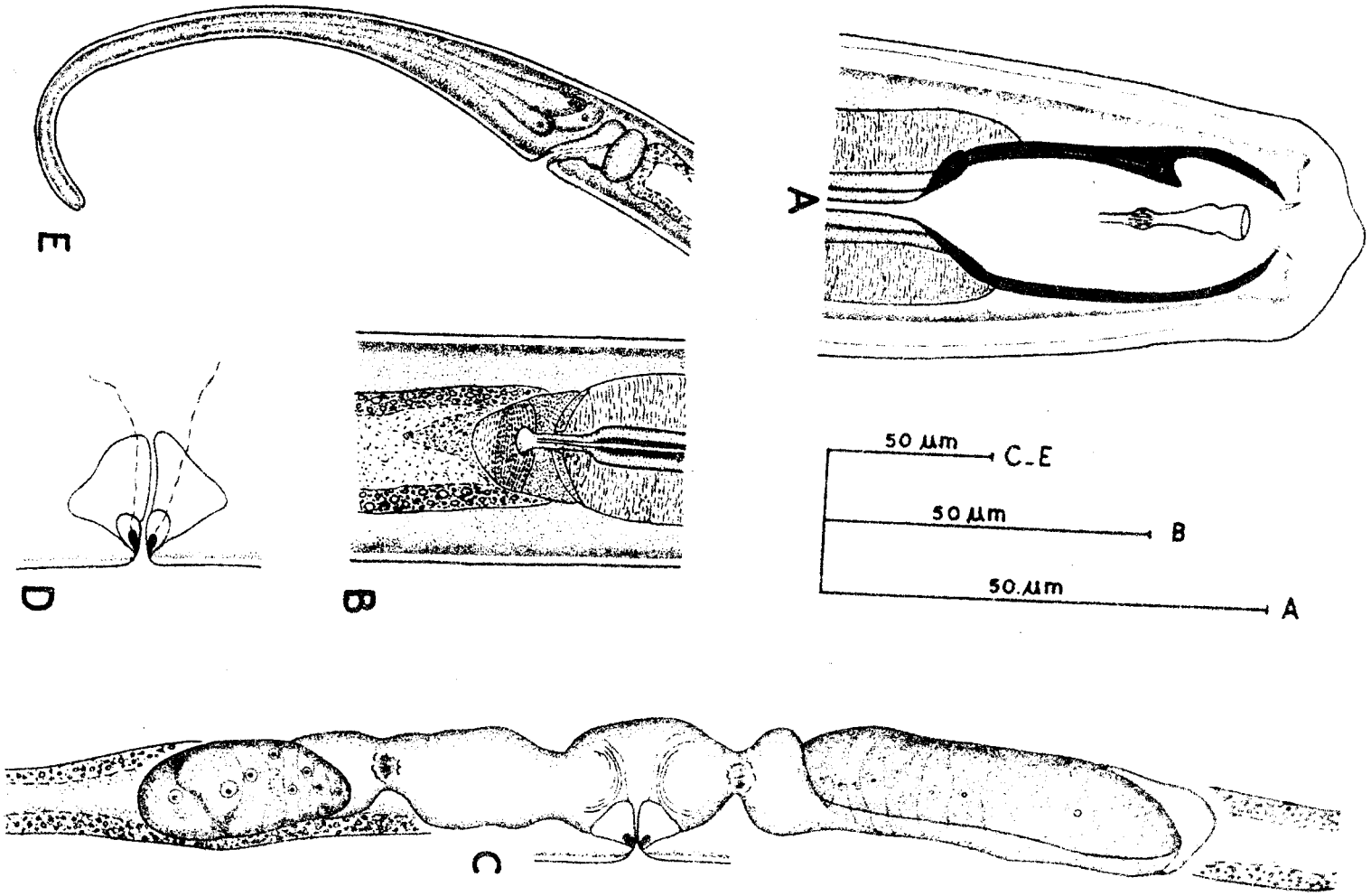

E
A
50 µm
C-E
50 µm
B
50 µm
A
D
B
C

PLATE VIII

Figs. A - D — *Monenchus aquaticus*

A - Entire female

B - Oesophageal region

C - Sexual branches

D - Actual shape of entire female.

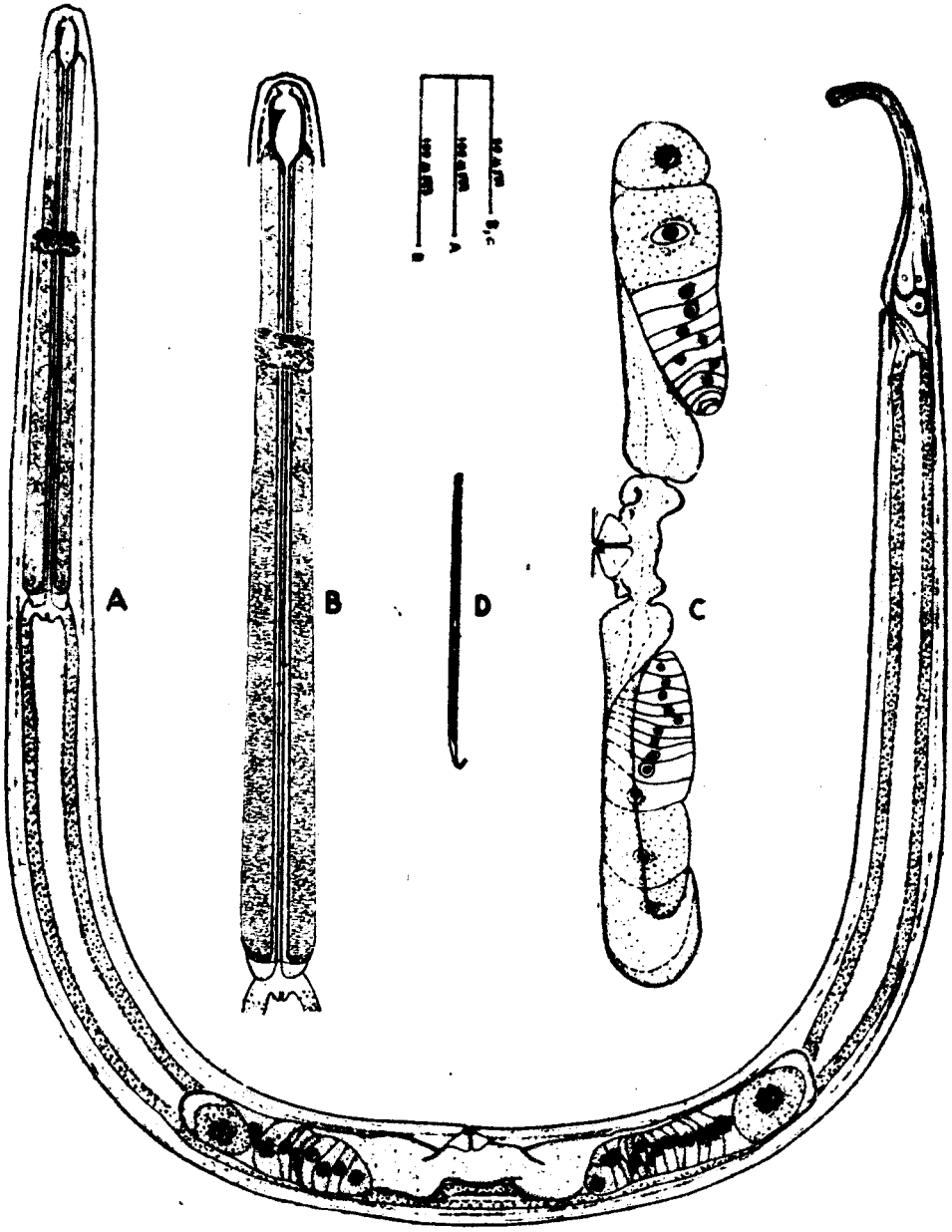

A
B
D
C

PLATE IX

Figs. A – M — *Monanchus aquaticus*

A – M Anterior ends

G – M Posterior ends

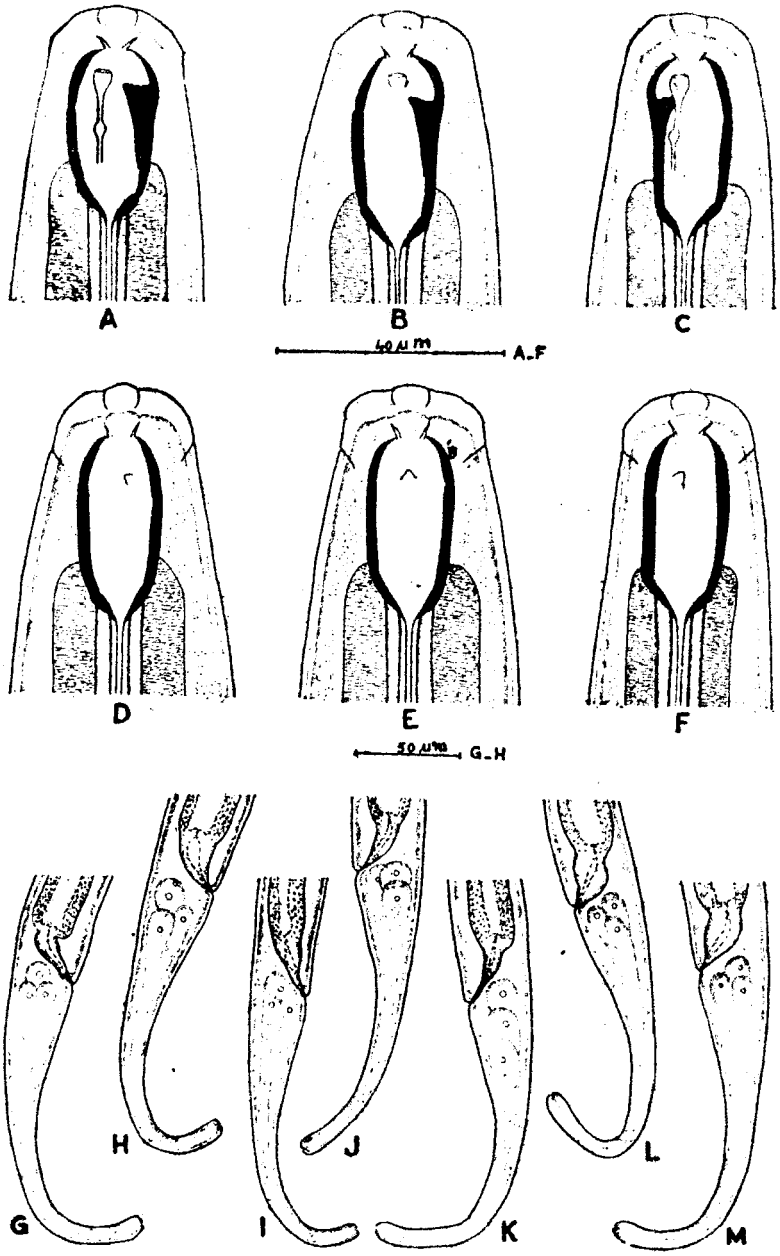

A
B
C
40 µm
A-F
D
E
F
50 µm
G-H
G
H
I
J
K
L
M

PLATE X

Figs. A - K *Monanchus acuaticus*

A - Cephalic musculature

B - Oesophago-intestinal junction

C - Position of oviduct and ovary

D - Uterus-oviduct junction in surface view

E - Uterus-oviduct junction in median view

F - Muscles at the vulva region

G - Vulval glands

H - Vulva in dorso-ventral view

I - Tail with caudal muscles

J - Anal region in dorso-ventral view

K - Anal region showing rectal glands.

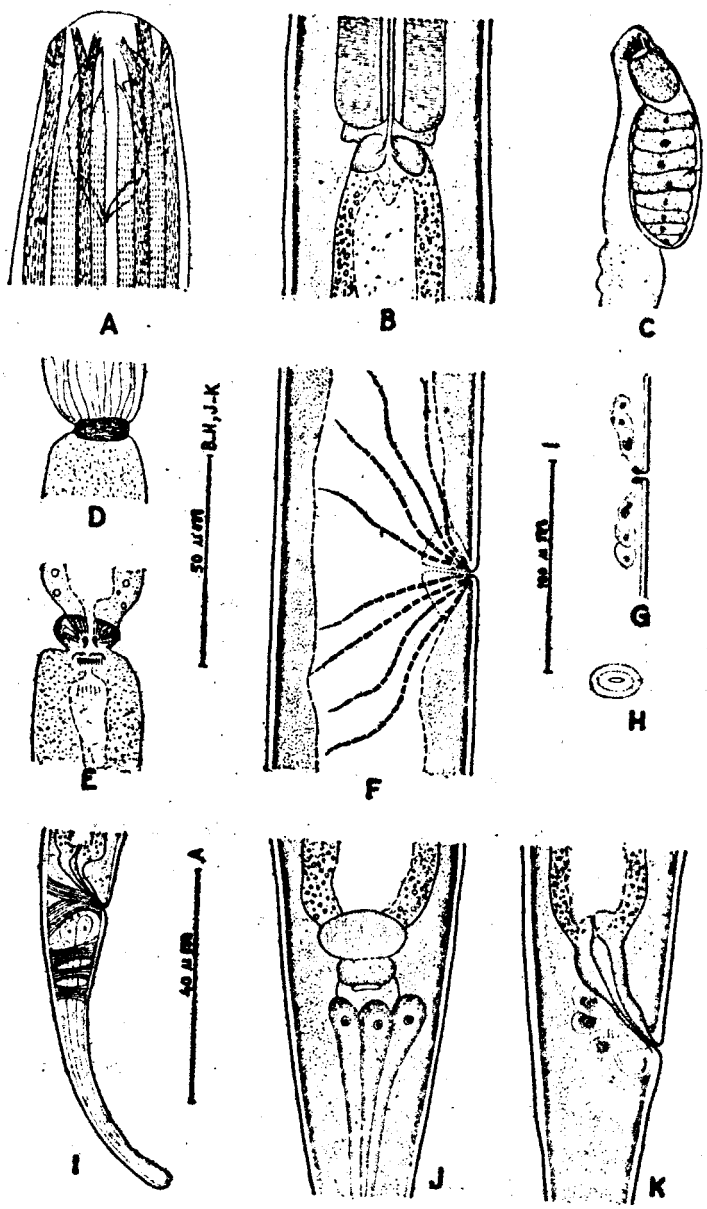

A
B
C
D
E
50 µm
B,H,J-K
F
G
H
I
40 µm
A
J
K

PLATE XI

Figs. A - G *Monocelus aquaticus*

A - *En face* view

B - Cross section buccal cavity at level of dorsal tooth.

C - Cross section buccal cavity below the dorsal tooth.

D - Cross section immediately below the buccal cavity.

E - Cross section of oesophagus at base

F - Cross section through cardia

G - Cross section intestine.

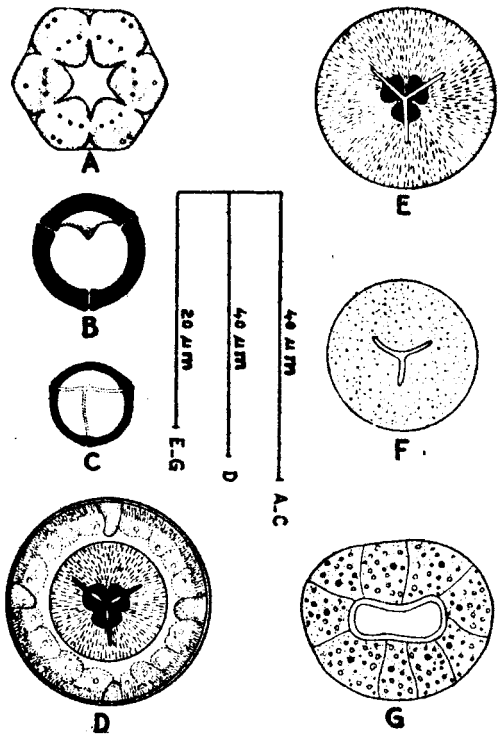

A
B
C
D
E
F
G
E-G
D
A-C
20 µm
40 µm
40 µm

PLATE XII

Figs. A - F *Meronchus niddensis*

A - Anterior end

B - Anterior end (superfacial view)

C - Oesophago-intestinal junction

D - Anterior sexual branch

E - Vulval region

F - Posterior end.

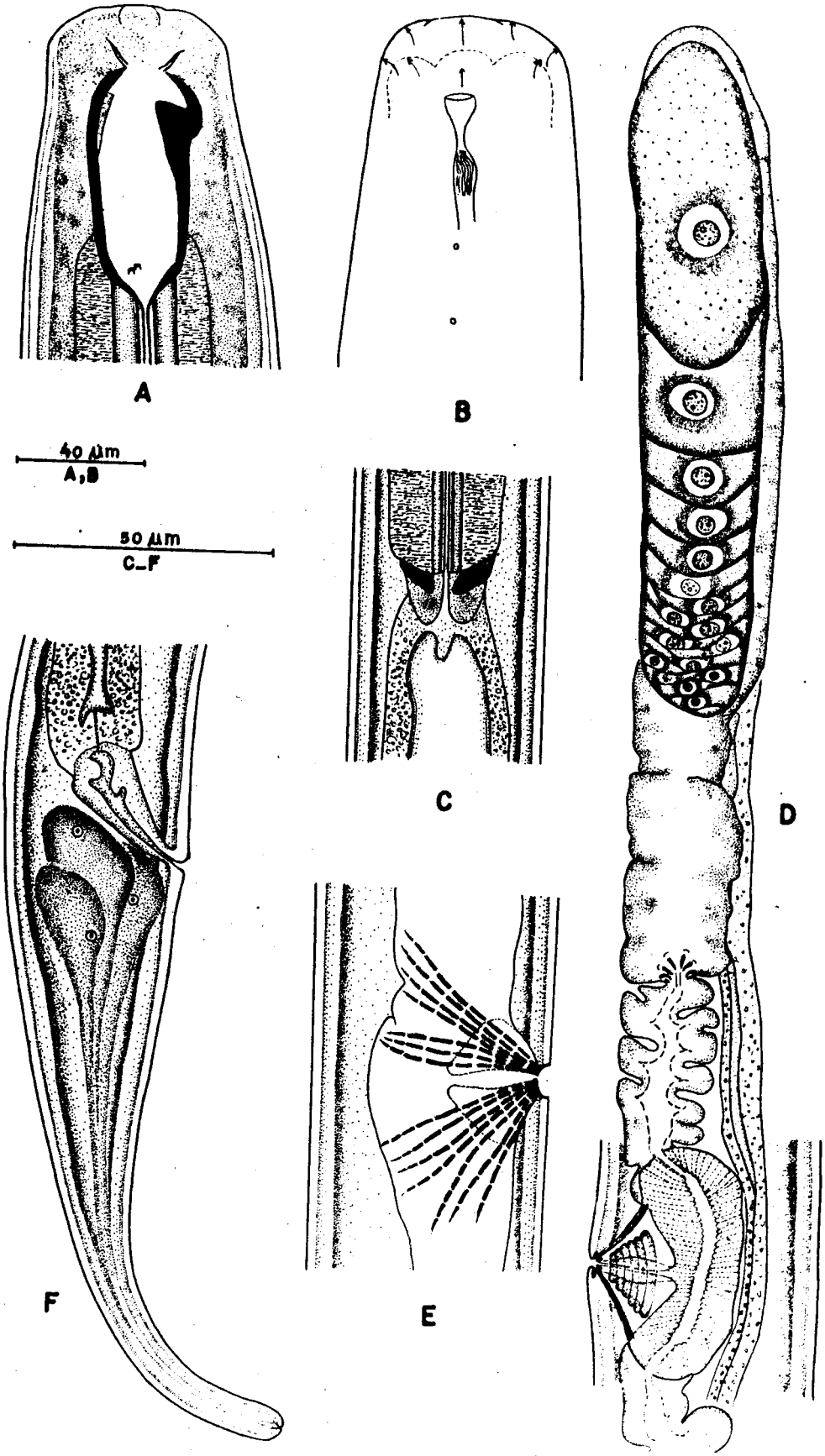

A
B
40 µm
A,B
50 µm
C–F
C
D
E
F

PLATE XIII

Figs. A - C — *Clarkus papillatus*

A - Anterior end

B - Sexual branches

C - Posterior end.

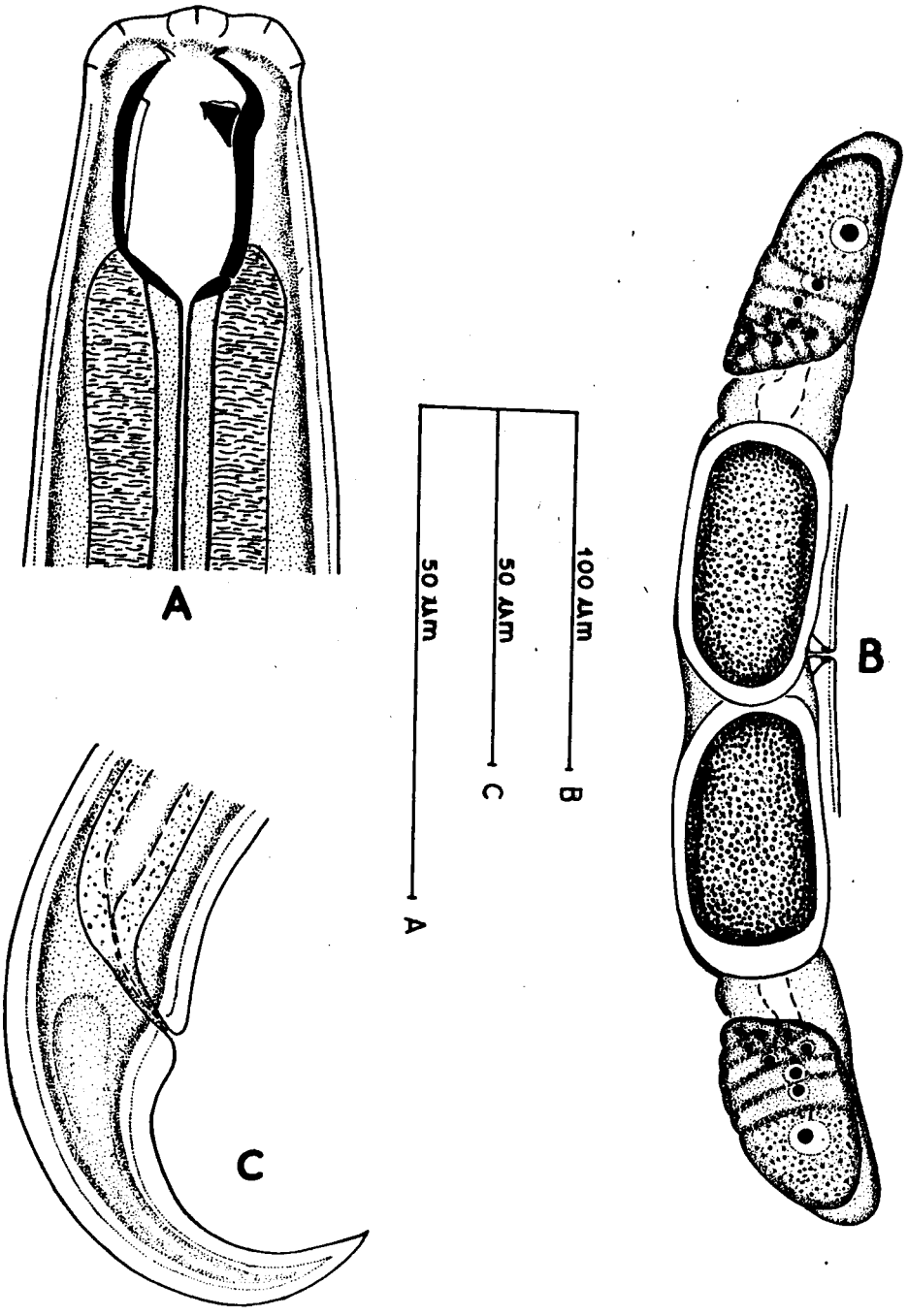

A
100 µm
50 µm
50 µm
B
C
A
B
C

PLATE XIV

Figs. A - B — *Clarkus propapillatus*

A - Anterior end

B - Posterior end

Figs. C - D — *Clarkus sheri*

C - Anterior end

D - Posterior end.

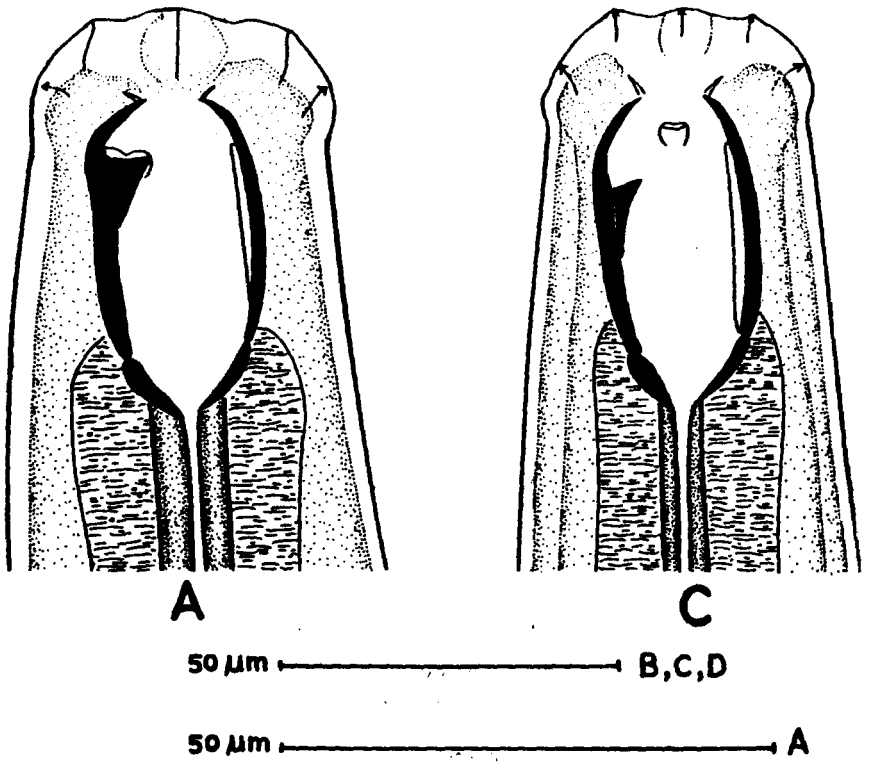

A
C
50 µm
B,C,D
50 µm
A
B
D

PLATE XV

Figs. A - C — Mylonchulus striatus

A - Anterior end

B - Posterior sexual branch

C - Posterior end.

Figs. D - F — Prionchulus muscorum

D - Anterior end.

E - Anterior sexual branch

F - Posterior end.

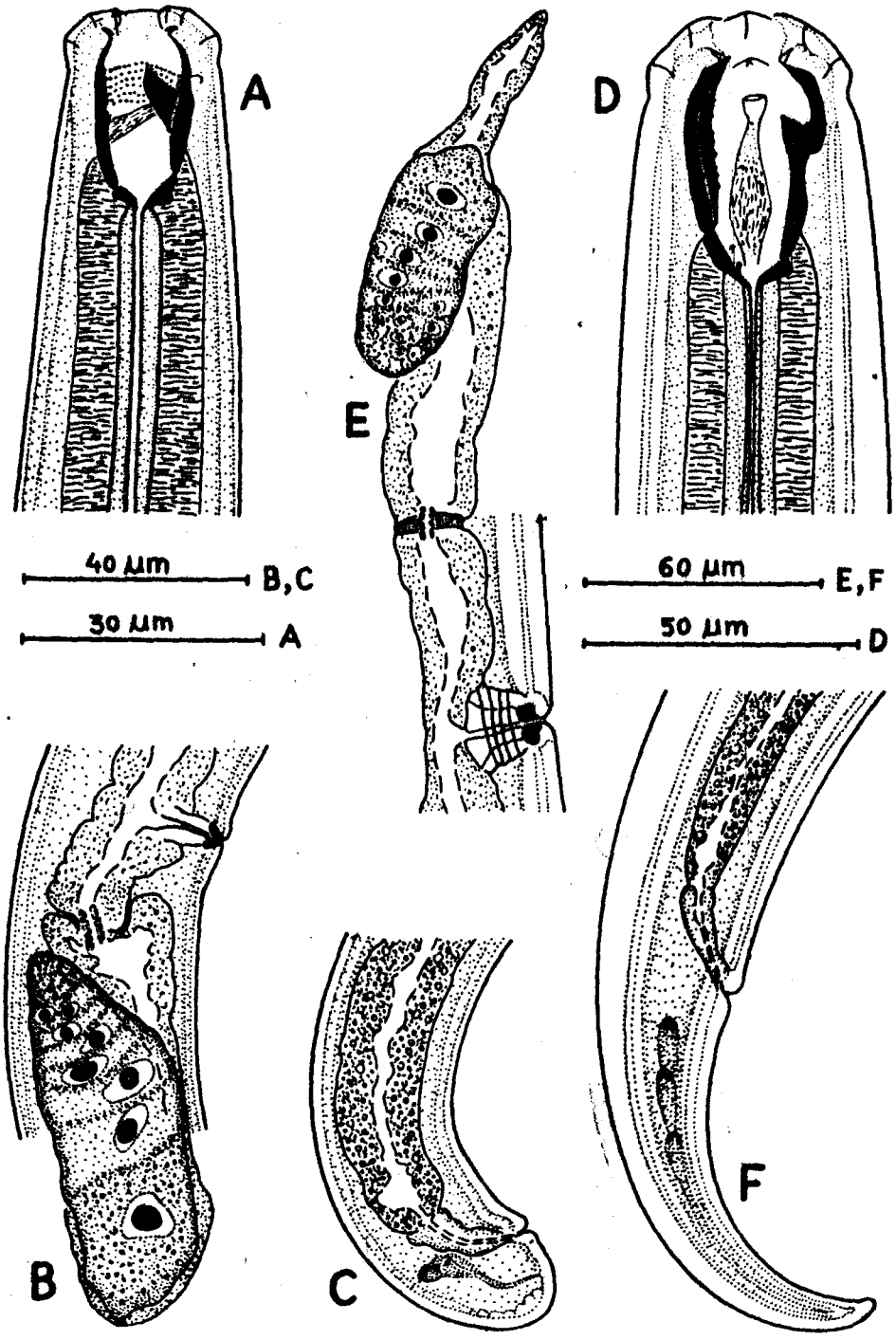

A
E
D
40 µm
B,C
30 µm
A
60 µm
E,F
50 µm
D
B
C
F

PLATE XVI

Figs. A - E — *Prionchulus longus*

A - Oesophageal region

B - Anterior end.

C - Oesophago-intestinal junction

D - Sexual branches

E - Posterior end.

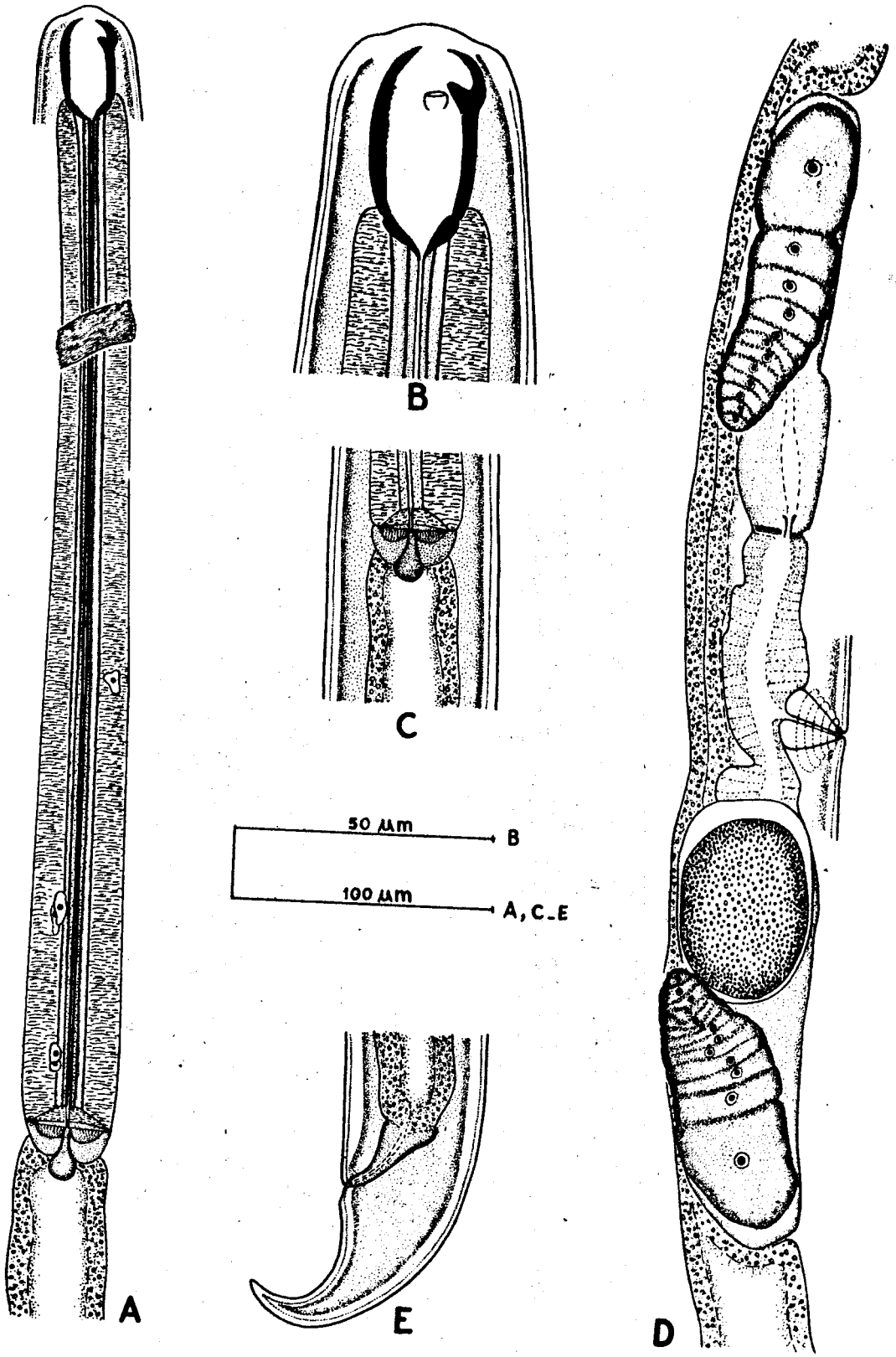

A
B
C
50 µm
B
100 µm
A, C-E
D
E

PLATE XVII

Figs. A - F — Actus salvadorinus n. gen., n. sp.

A - Entire female.

B - Anterior end

C - Buccal cavity (slightly dorsolateral)

D - Sexual branches

E - Posterior end.

F - Tail terminus.

Figs. G - I — Paracrassibucca jenseni n. gen., n. sp.

G - Anterior end

H - Sexual branches

I - Posterior end.

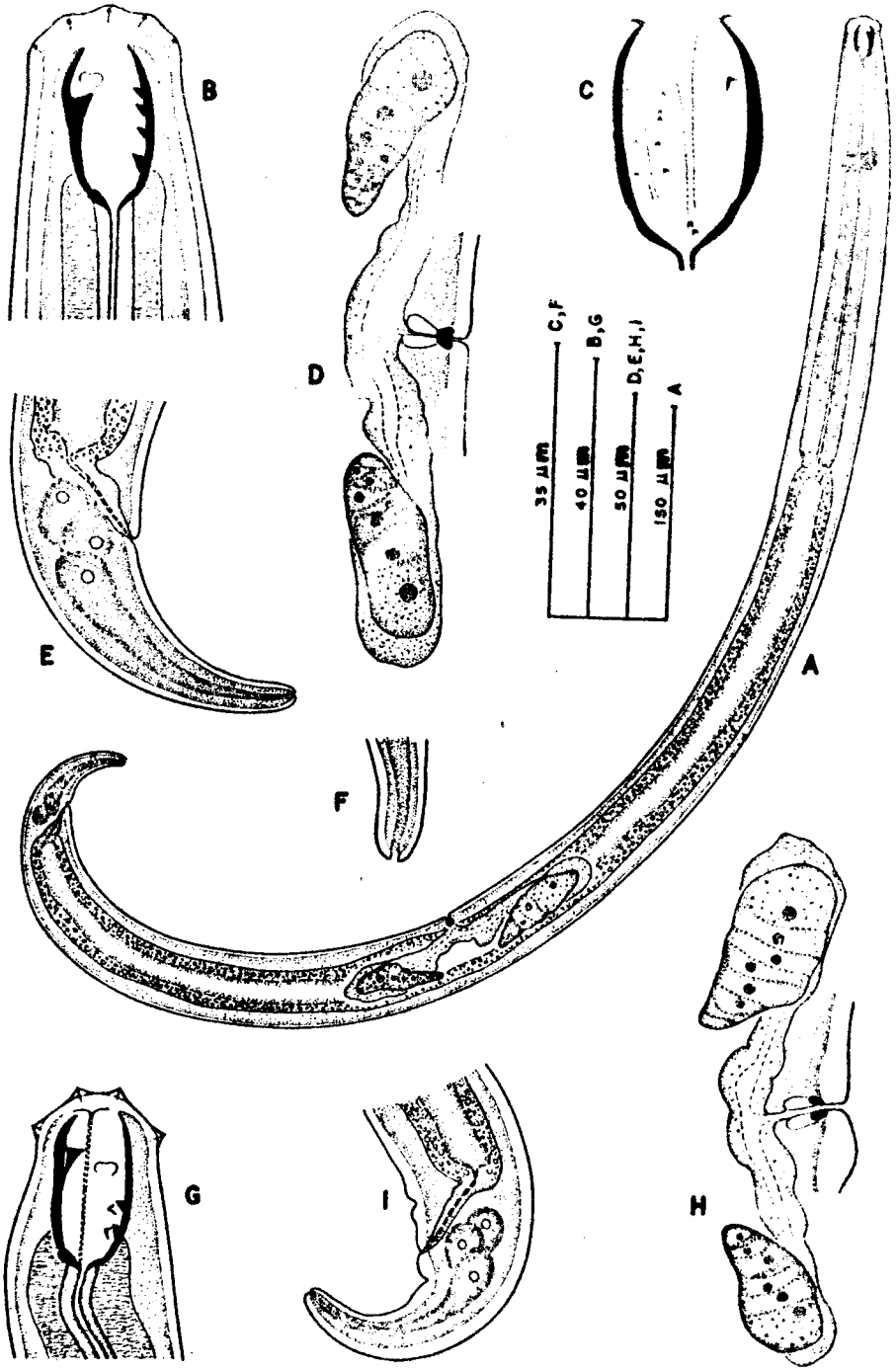

B
C
D
E
F
A
G
I
H
C,F
B,G
D,E,H,I
A
35 µm
40 µm
50 µm
150 µm

PLATE XVIII

Figs. A - B — *Mylonchulus agriculturae*

A - Anterior end

B - Posterior end

Figs. C - E — *Mylonchulus lacustris*

C - Anterior end

D - Sexual branches

E - Posterior end

Figs. F - G — *Mylonchulus nainitalensis*

F - Anterior end

G - Posterior end.

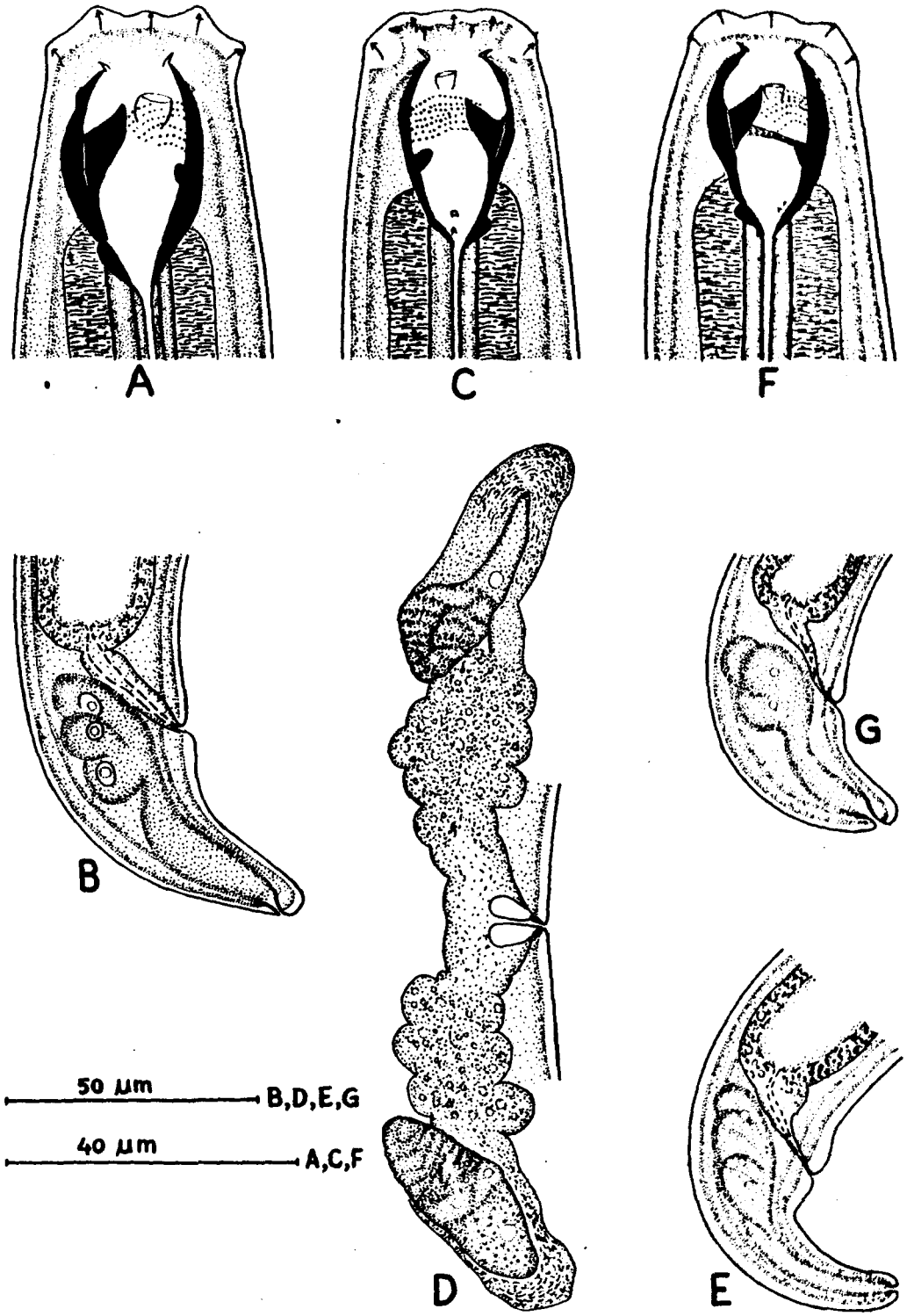

A
C
F
B
G
D
E
50 µm
B,D,E,G
40 µm
A,C,F

PLATE XIX

Figs. A - C — Mylonchulus andrassyi n. sp.

A - Anterior end

B - Sexual branches

C - Posterior end.

Figs. D - F — Mylonchulus brachyuris

D - Anterior end

E - Sexual branches

F - Posterior end

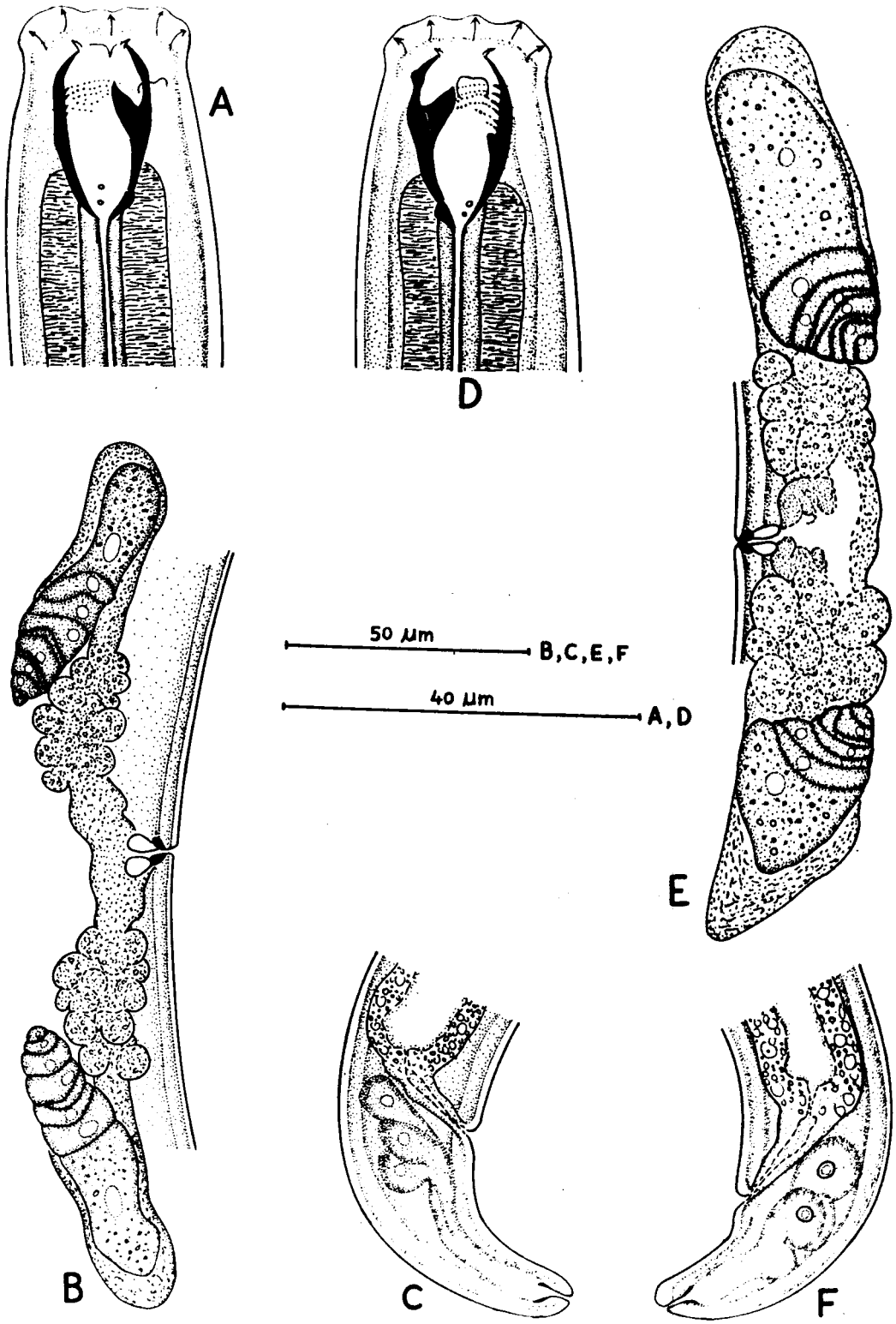

A
D
E
B
50 µm
B,C,E,F
40 µm
A,D
C
F

PLATE XX

Figs. A - B — Mylonchulus incurvus

A - Anterior end

B - Posterior end

Figs. C - D — Mylonchulus hawaiiensis

C - Anterior end

D - Posterior end.

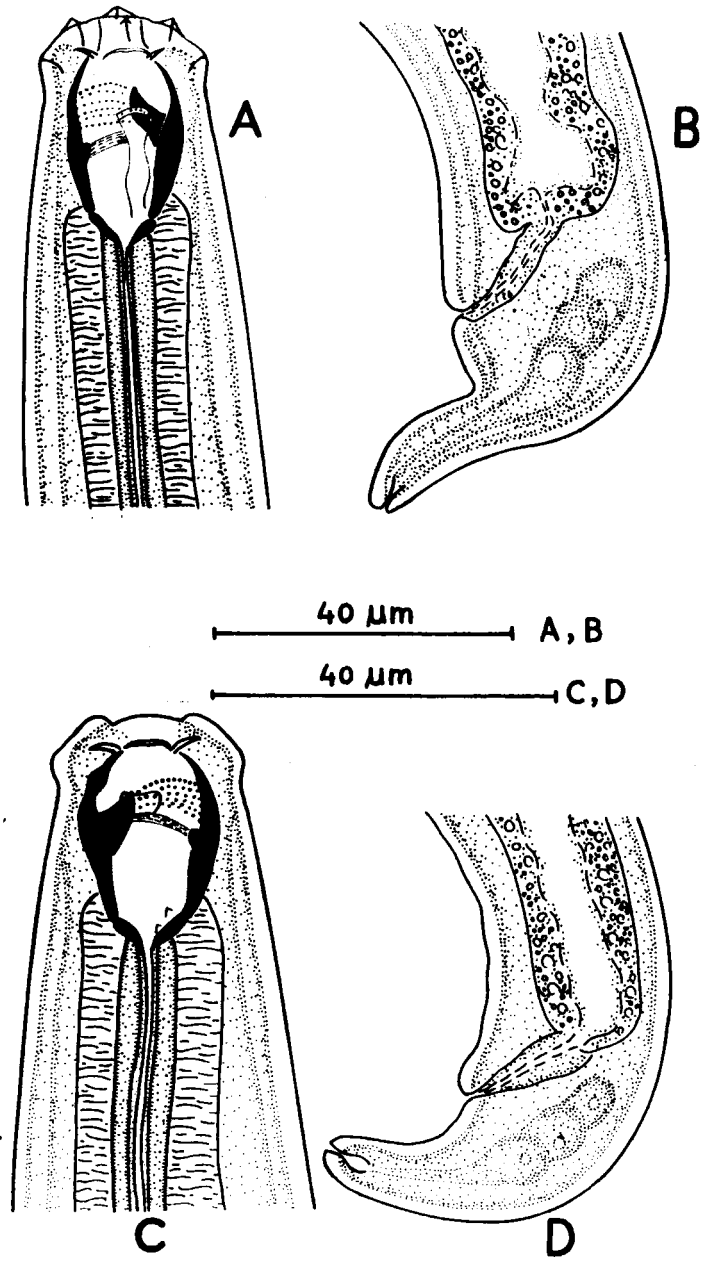

A
B
40 µm
A, B
40 µm
C, D
C
D

PLATE XXI

Figs. A - D — *Mylonchulus mulveyi*

A - Anterior end

B - Oesophago-intestinal junction

C - Anterior sexual branch

D - Posterior end.

Figs. E - G — *Mylonchulus indus*

F - Anterior end

F - Anterior sexual branch

G - Posterior end.

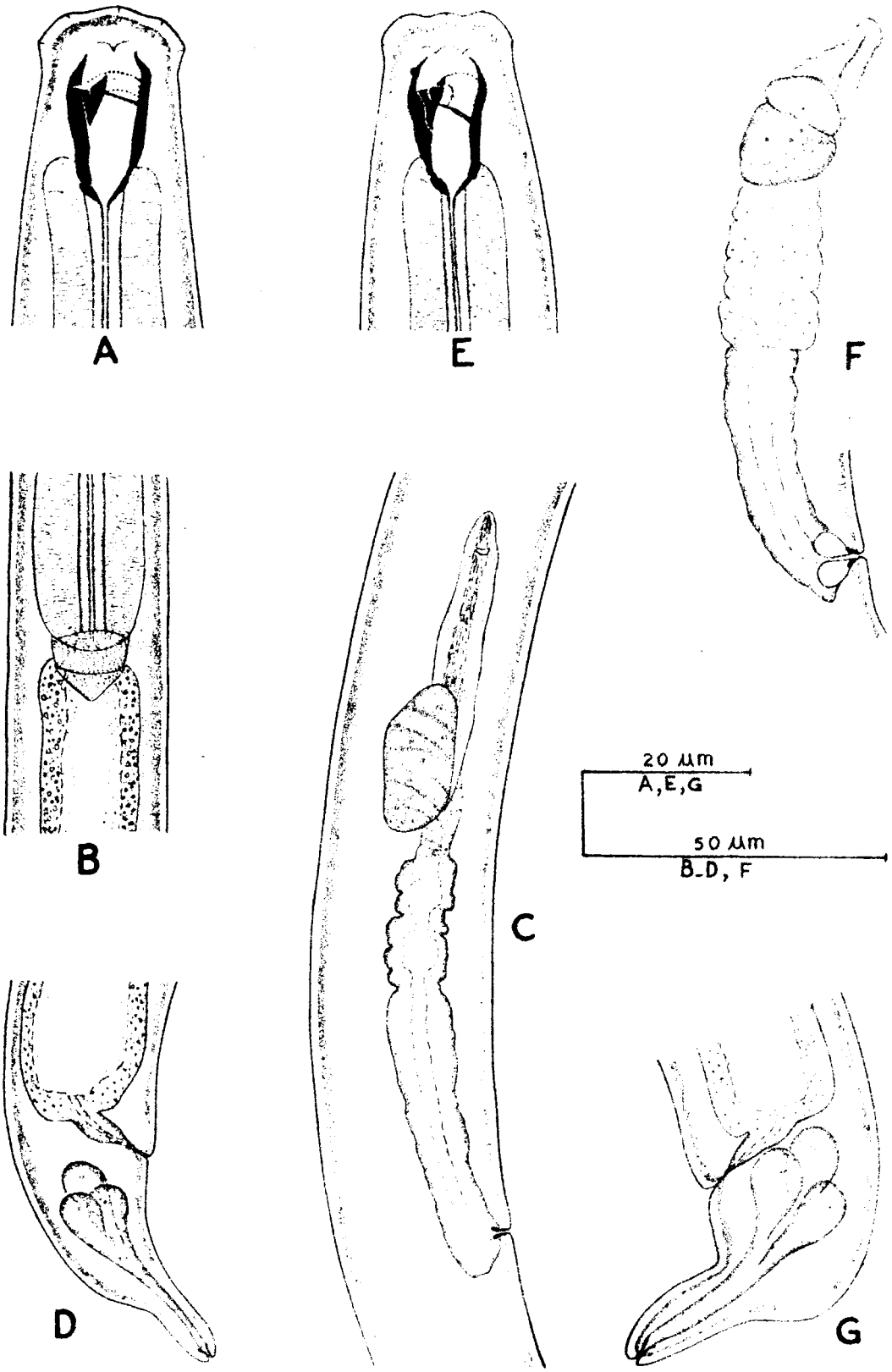

A
E
F
B
C
20 µm
A,E,G
50 µm
B-D, F
D
G

PLATE XXII

Figs. A - C — Mylonchulus elevatus n. sp.

A - Anterior end

B - Sexual branches

C - Posterior end.

Figs. D - G — Mylonchulus lemili n. sp.

D - Anterior end (superficial view)

E - Anterior end

F - Sexual branches

G - Posterior end

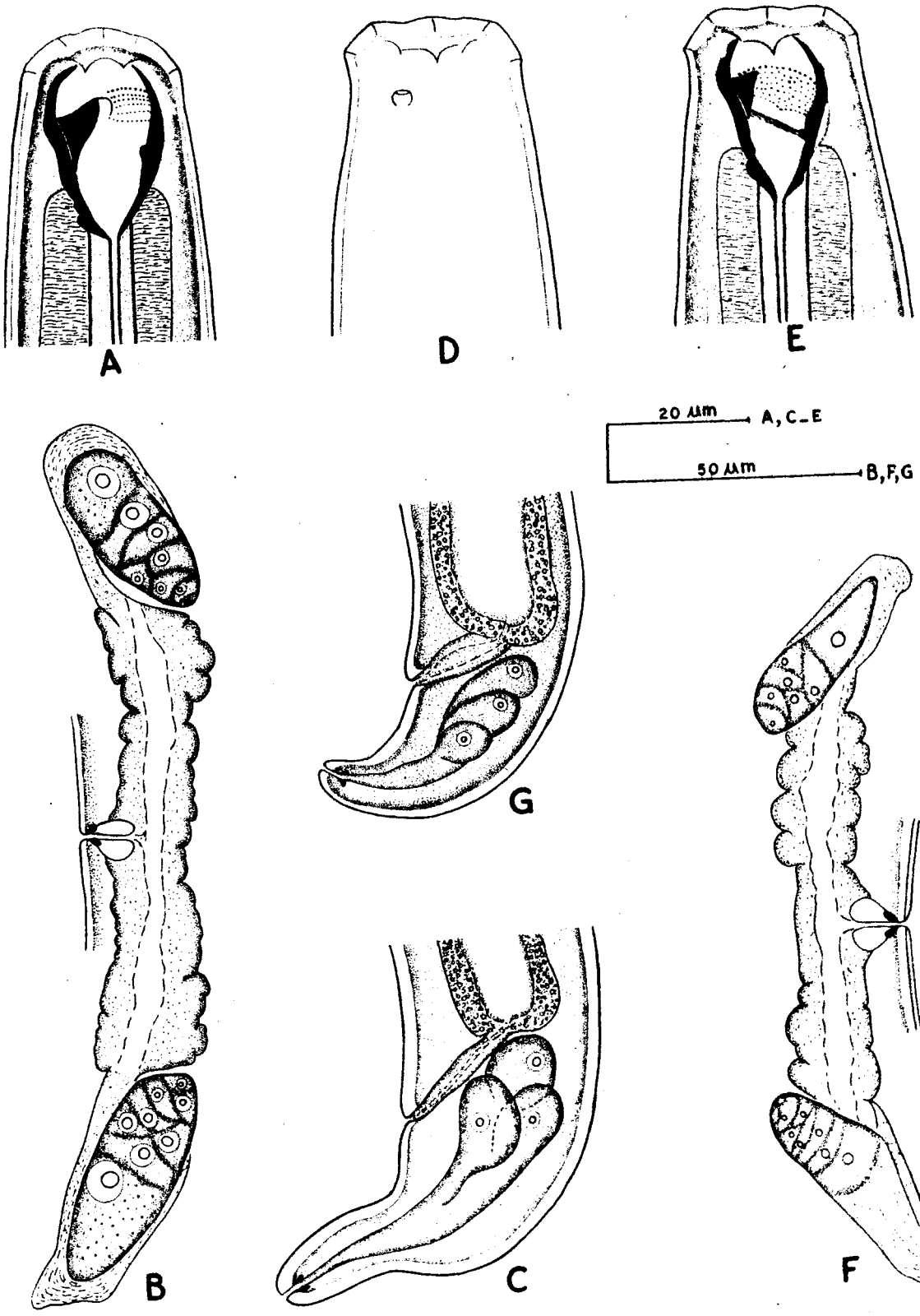

A
D
E
20 µm
A, C-E
50 µm
B, F, G
G
B
C
F

PLATE XXIII

Figs. A– C Mylonchulus aquaticus n. sp.

A – Anterior end

B – Sexual branches

C – Posterior end.

A
50 µm
B, C
50 µm
A
C
B

PLATE XXIV

Figs. A - C — *Mylenchulus nodosatus* n. sp.

A - Anterior end

B - Sexual branches

C - Posterior end

Figs. D - F — *Mylenchulus kharai* n. sp.

D - Anterior end

E - Sexual branches

F - Posterior end.

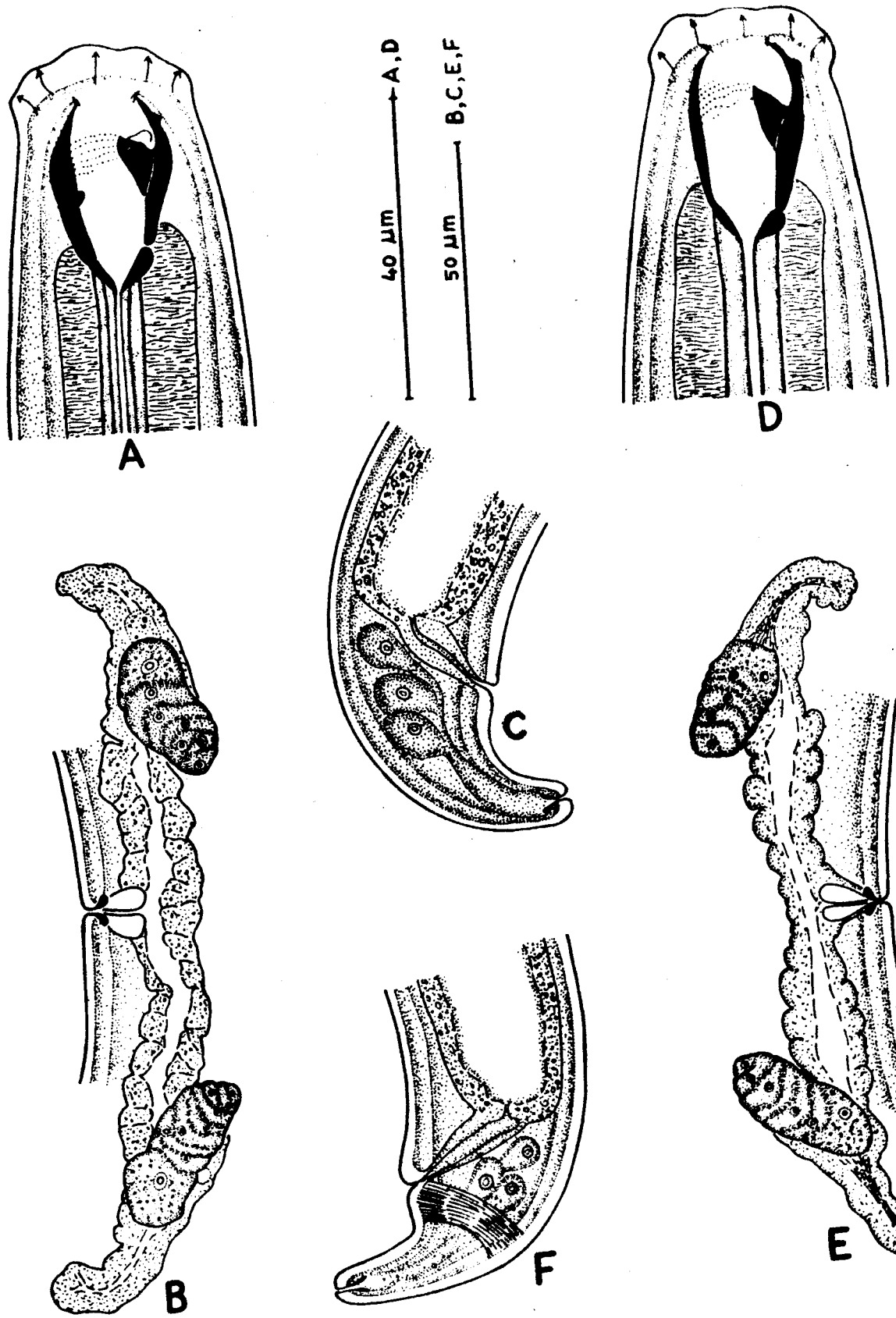

A,D
B,C,E,F
40 µm
50 µm
A
B
C
D
E
F

PLATE XXV

Figs. A - E — Cobbonchus parabulbosus n. sp.

A - Anterior end

B - Oesophago-intestinal junction

C - Posterior female sexual branch

D - Female posterior end

E - Male posterior end.

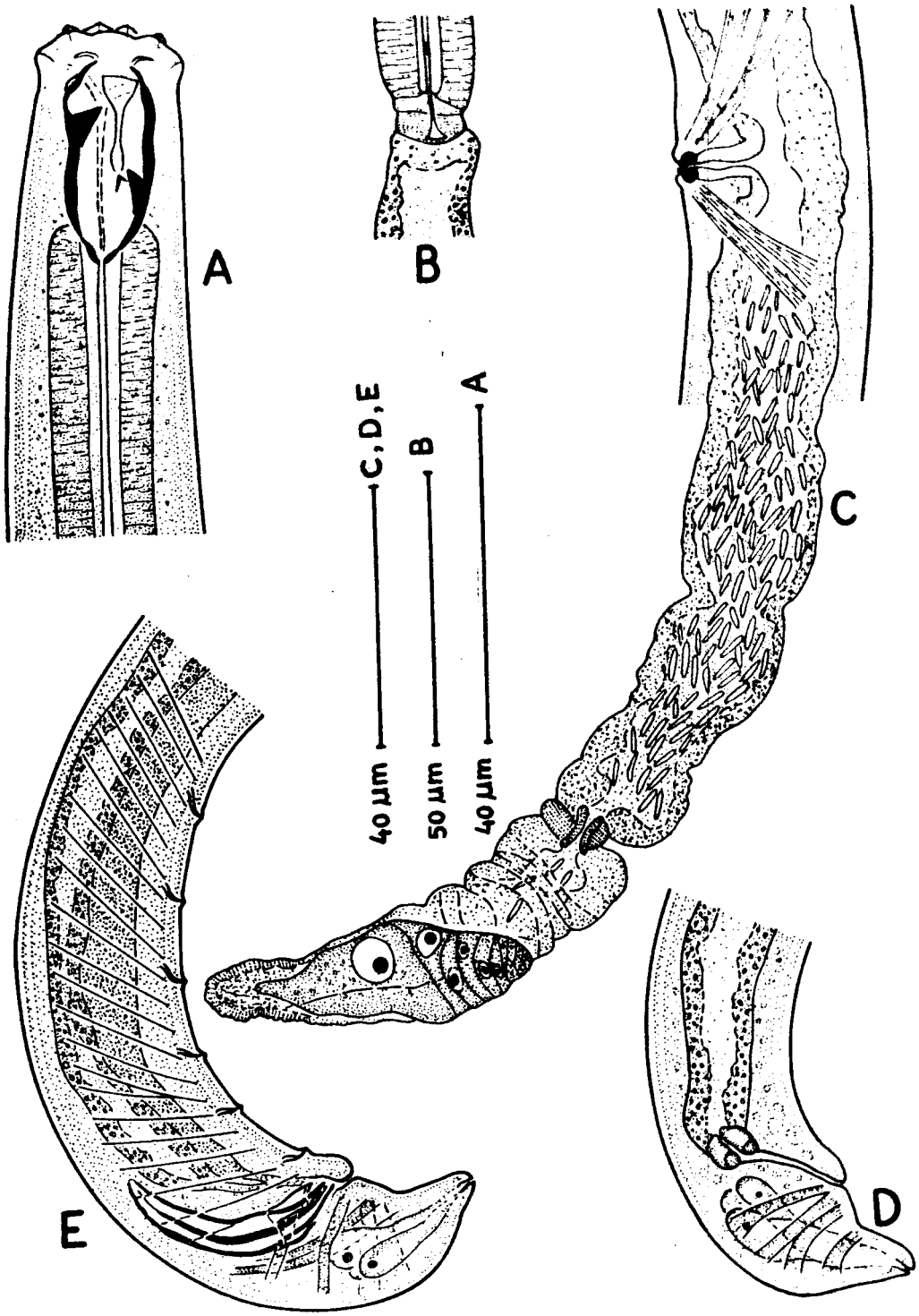

A
B
C
D
E
C,D,E
B
A
40 µm
50 µm
40 µm

PLATE XXVI

Figs. A - F — *Anatonchus adami* n. sp.

A - Anterior end

B - Oesophago-intestinal junction

C - Anterior female sexual branch

D - Female posterior end

E - Male posterior end

F - Spicule, gubernaculum and lateral accessory piece

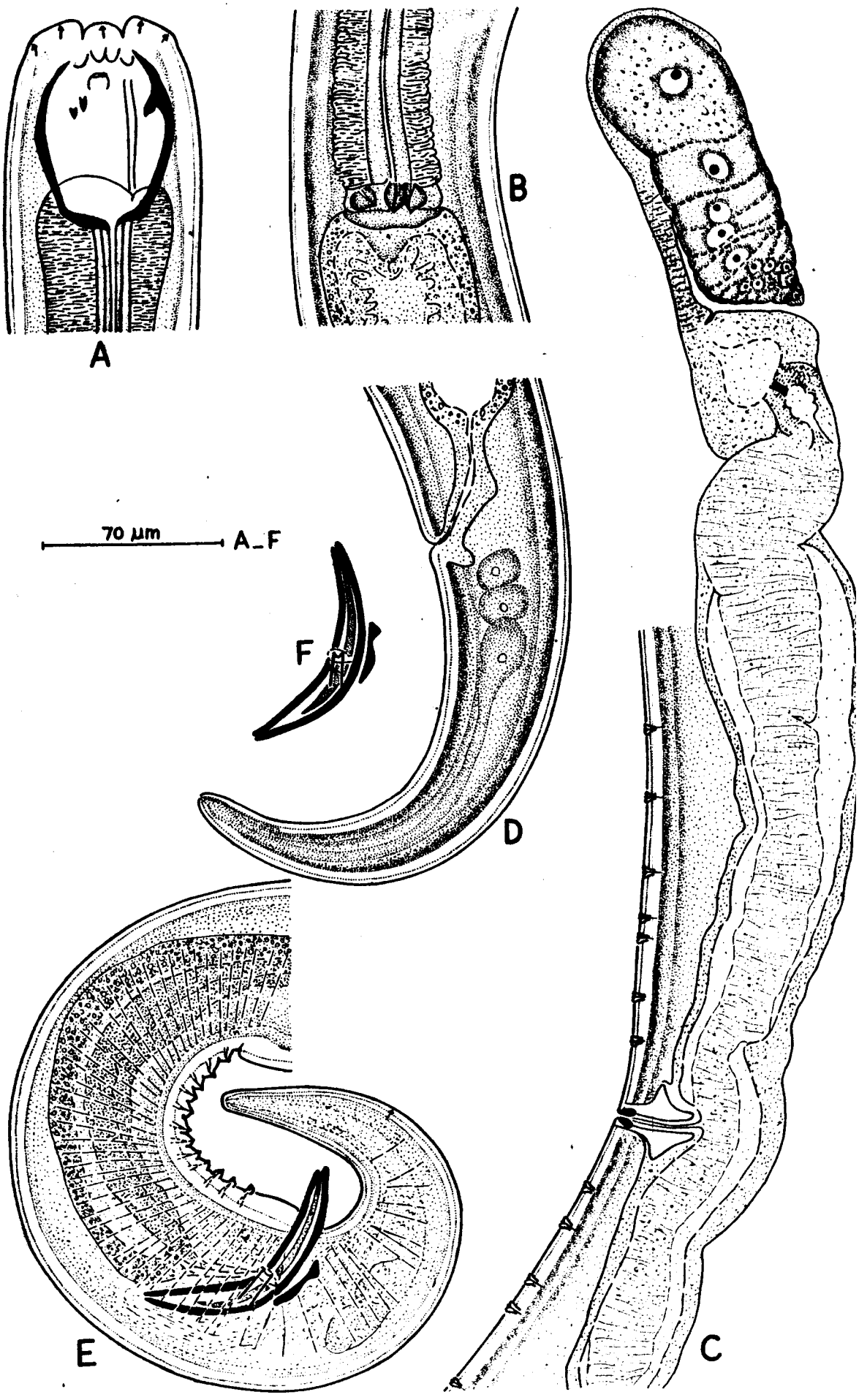

A
B
C
D
E
F
70 µm
A_F

PLATE XXVII

Figs. A - E *Anatonchus nadiri* n. sp.

A - Anterior end

V - Vulva and pre-vulval papillae.

C - Oesophago-intestinal junction

D - Posterior sexual branch and post vulval papillae

E - Posterior end.

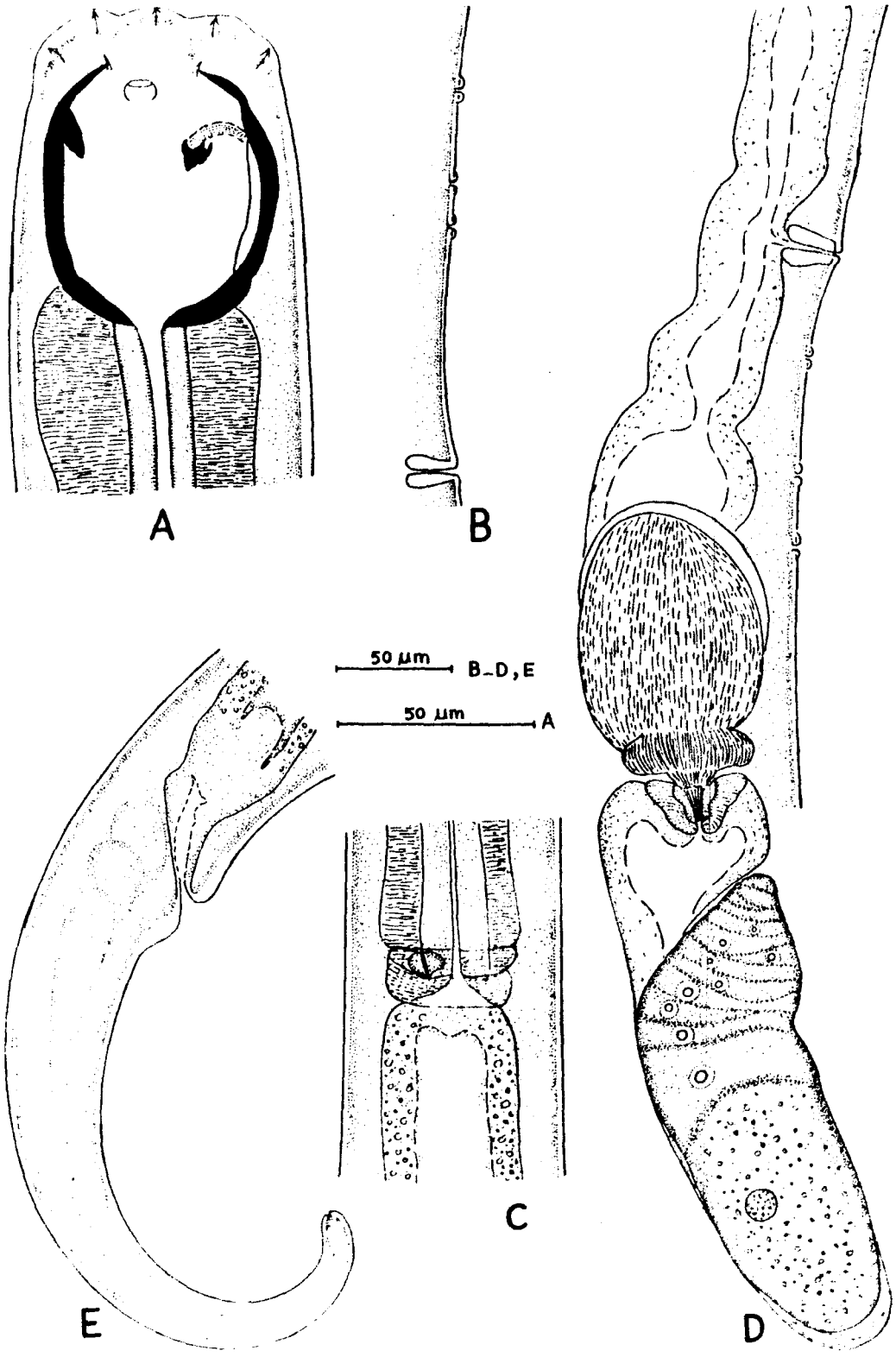

A
B
50 µm
B-D, E
50 µm
A
C
D
E

PLATE XXVIII

Figs. A - C — Micronchus nervus n. sp.

A - Anterior end.

B - Anterior sexual branch

C - Posterior end.

Figs. D - E — Micronchus thomasi

D - Anterior end

E - Posterior end.

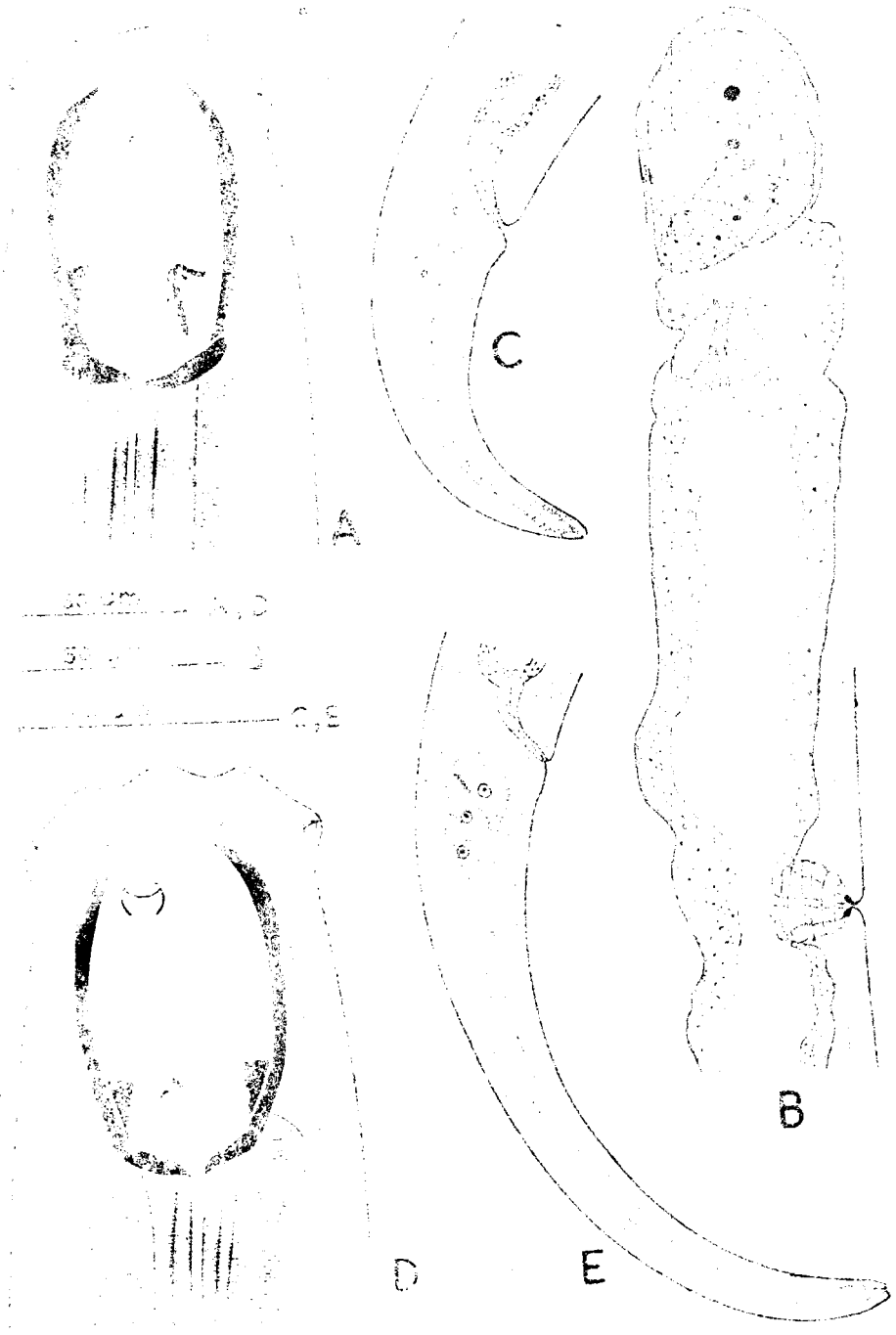

A
C
B
D
E

PLATE XXIX

Figs. A - D — Iotonchus trichurus

A - Anterior end

B - Oesophago-intestinal junction

C - Anterior sexual branch

D - Posterior end.

Figs. E - F — Iotonchus antidontus

E - Anterior end

F - Posterior end.

Fig. G - I — Iotonchus parabasidontus

G - Anterior end

H - Female posterior end

I - Male posterior end.

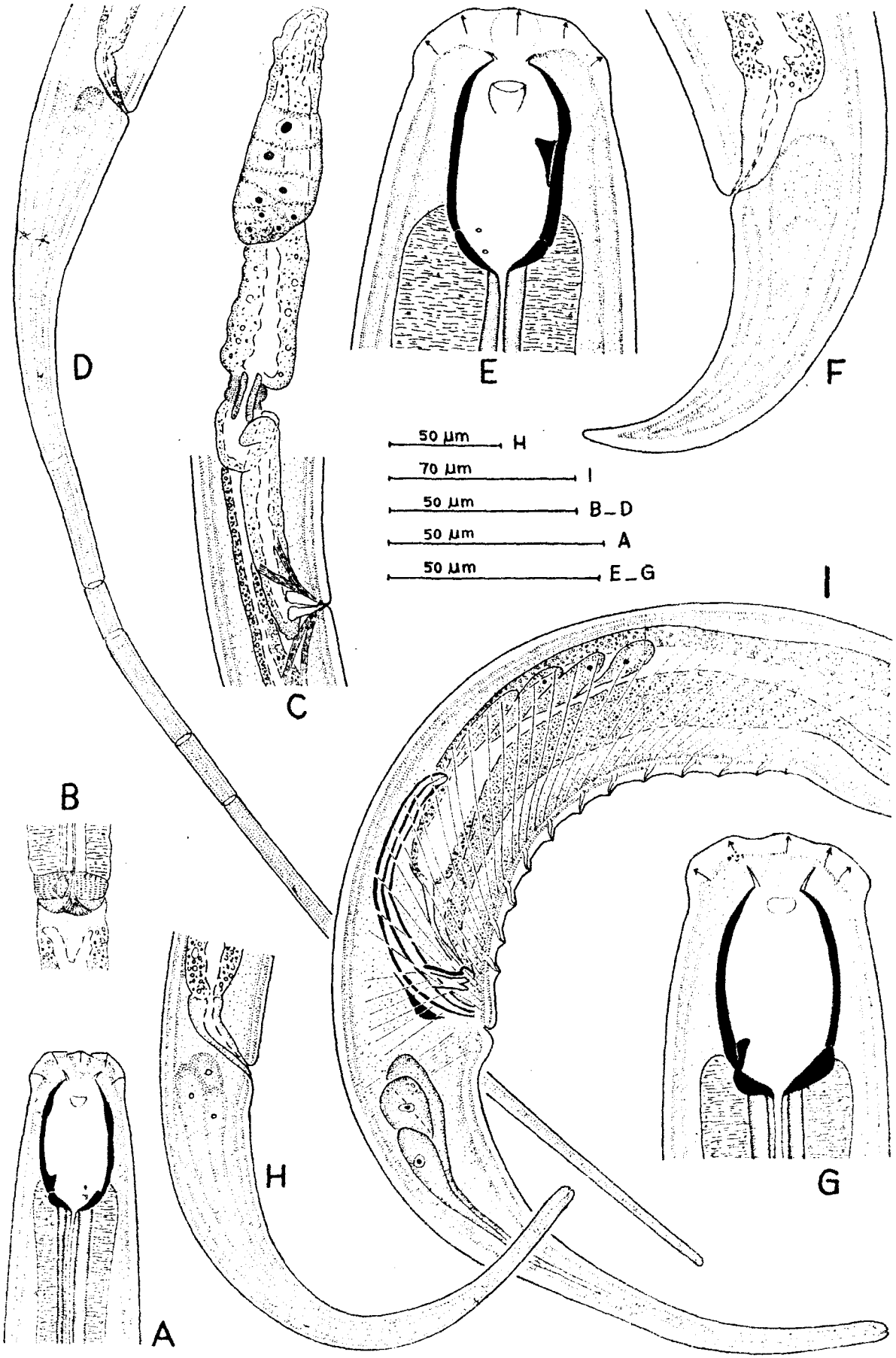

D
C
E
F
50 µm
H
70 µm
I
50 µm
B_D
50 µm
A
50 µm
E_G
I
B
H
G
A

PLATE XXX

Figs. A - D — *Ictenchus mulveyi* n. sp.

A - Anterior end.

B - Oesophago-intestinal junction

C - Sexual branches

D - Posterior end.

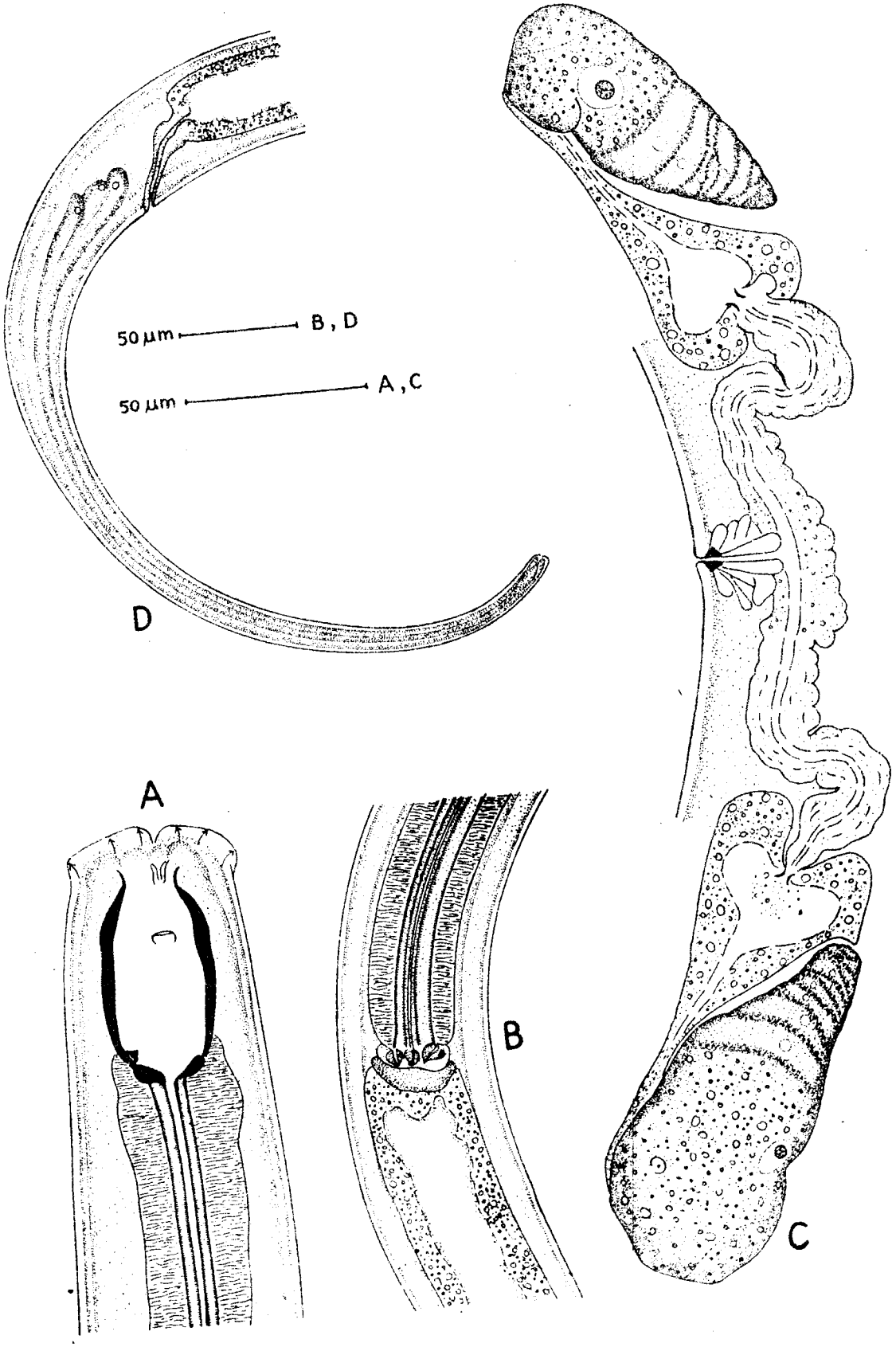

50 µm
B , D
50 µm
A , C
D
A
B
C

PLATE XXXI

Figs. A - D — *Iotenchus scomberi* n. sp.

A - Anterior end

B - Oesophago-intestinal junction

C - Sexual branches

D - Posterior end.

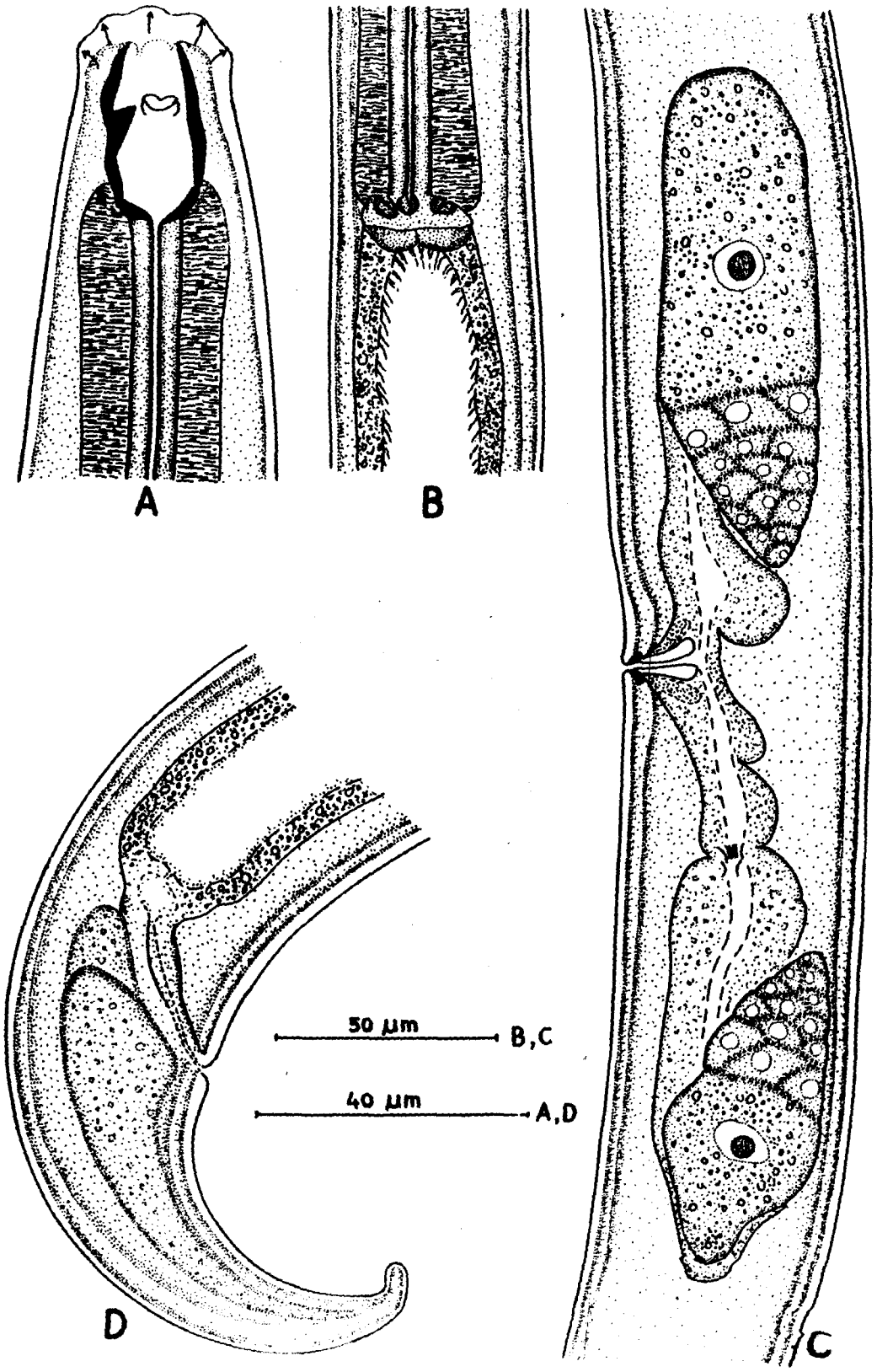

A
B
C
D
50 µm
B,C
40 µm
A,D

PLATE XXXII

Figs. A - D — *Iotanchus paraantidentus* n. sp.

A - Anterior end

B - Posterior sexual branch

C - D - Posterior ends.

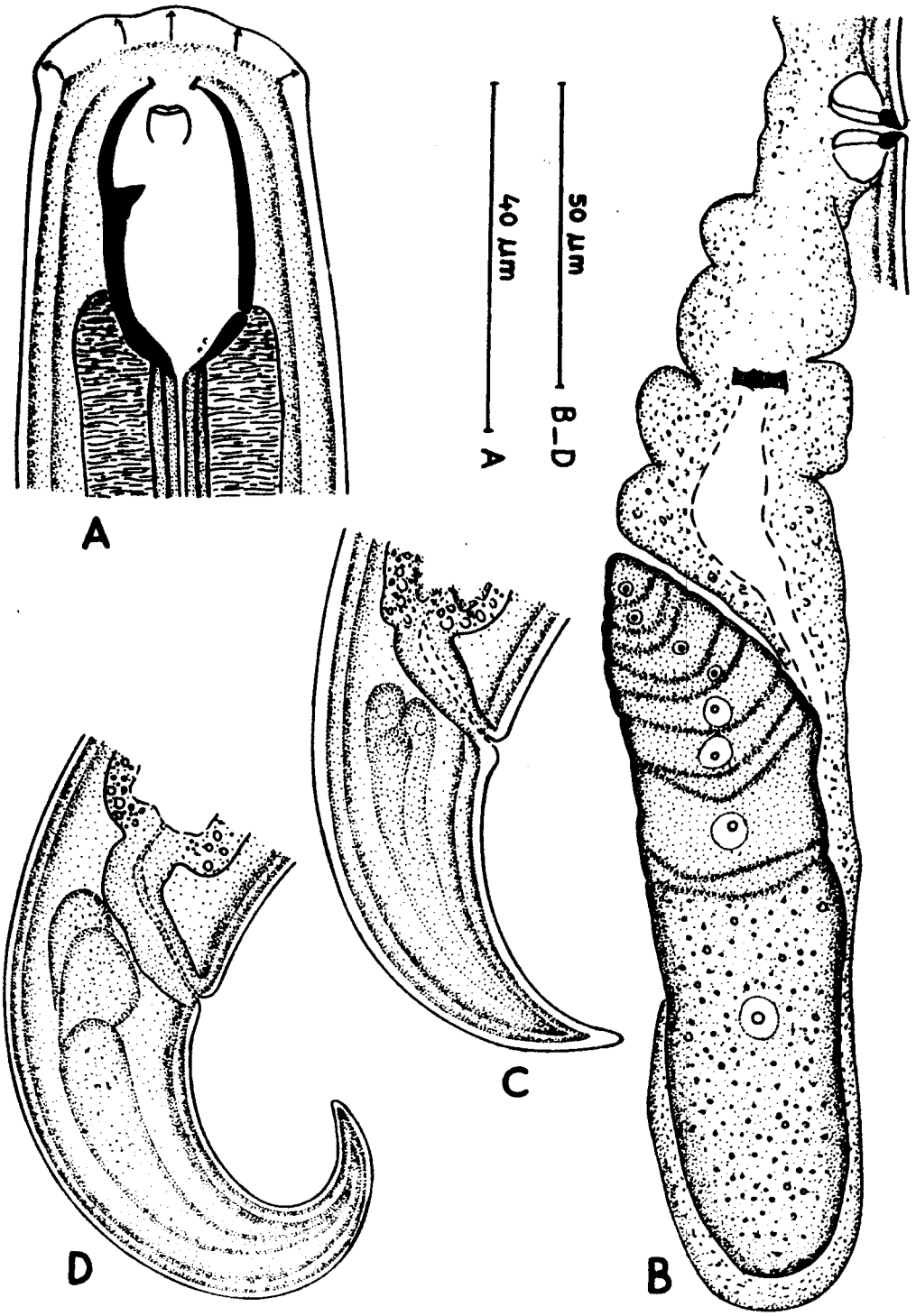

50 µm
B–D
40 µm
A
A
B
C
D

PLATE XXXIII

Figs. A - E — Iotonchus manbhoodi n. sp.

A - Anterior end (type population)

B - Anterior end (Raang population)

C - Oesophago-intestinal junction

D - Anterior sexual branch

E - Posterior end.

Figs. F - I — Iotonchus longicaudatus n. sp.

F - Anterior end

G - Oesophago-intestinal junction.

H - Anterior sexual branch

I - Posterior end.

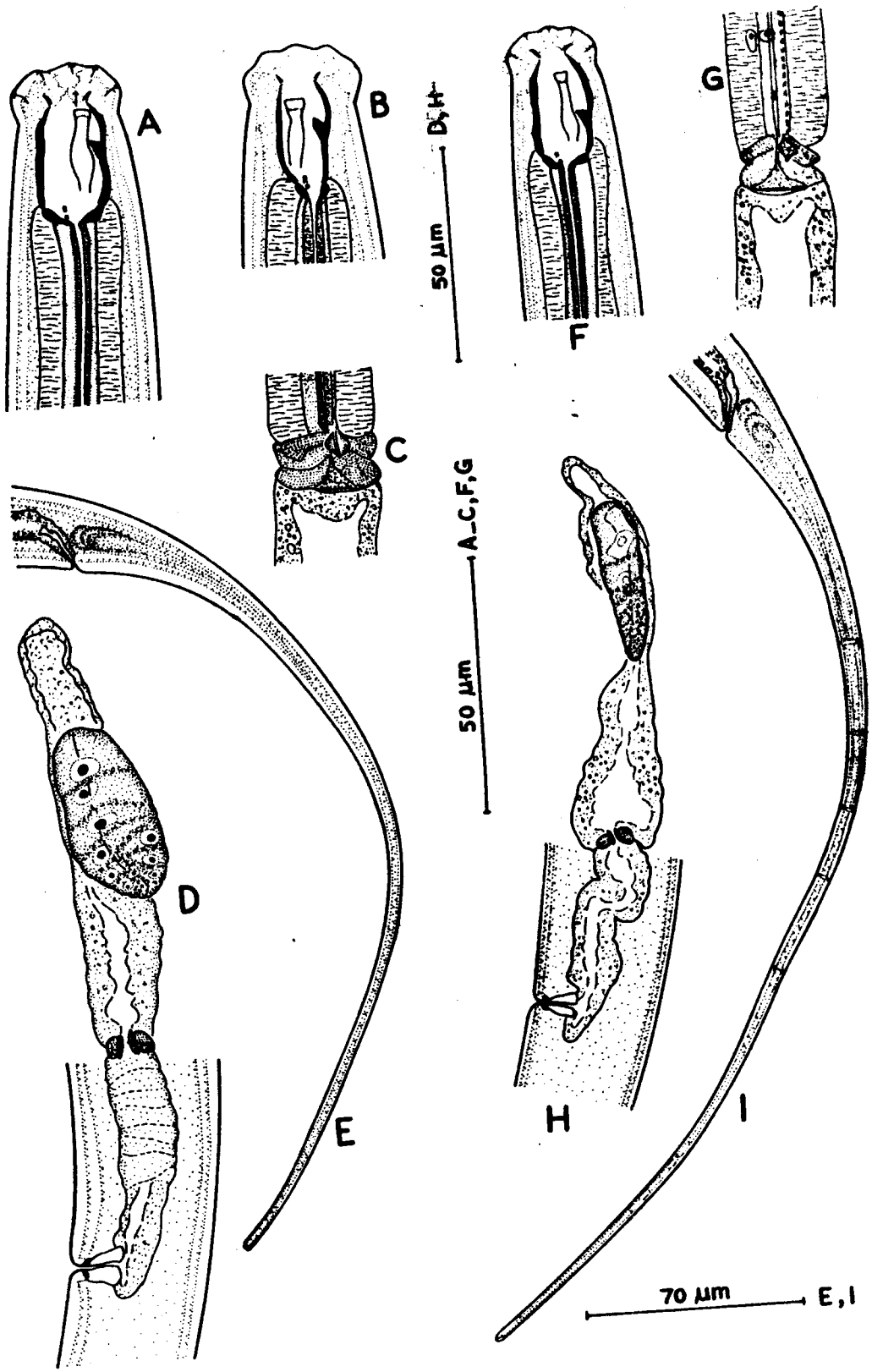

A
B
B,H
50 µm
F
G
C
A-C,F,G
50 µm
D
E
H
I
70 µm
E,I

PLATE XXXIV

Figs. A - G — Hadronchus shakili

A - Male anterior end

B - Female anterior end

C - Oesophago-intestinal junction.

D - Anterior female sexual branch

E - Female posterior end

F - Male posterior end

G - Spicule, gubernaculum and lateral accessory piece.

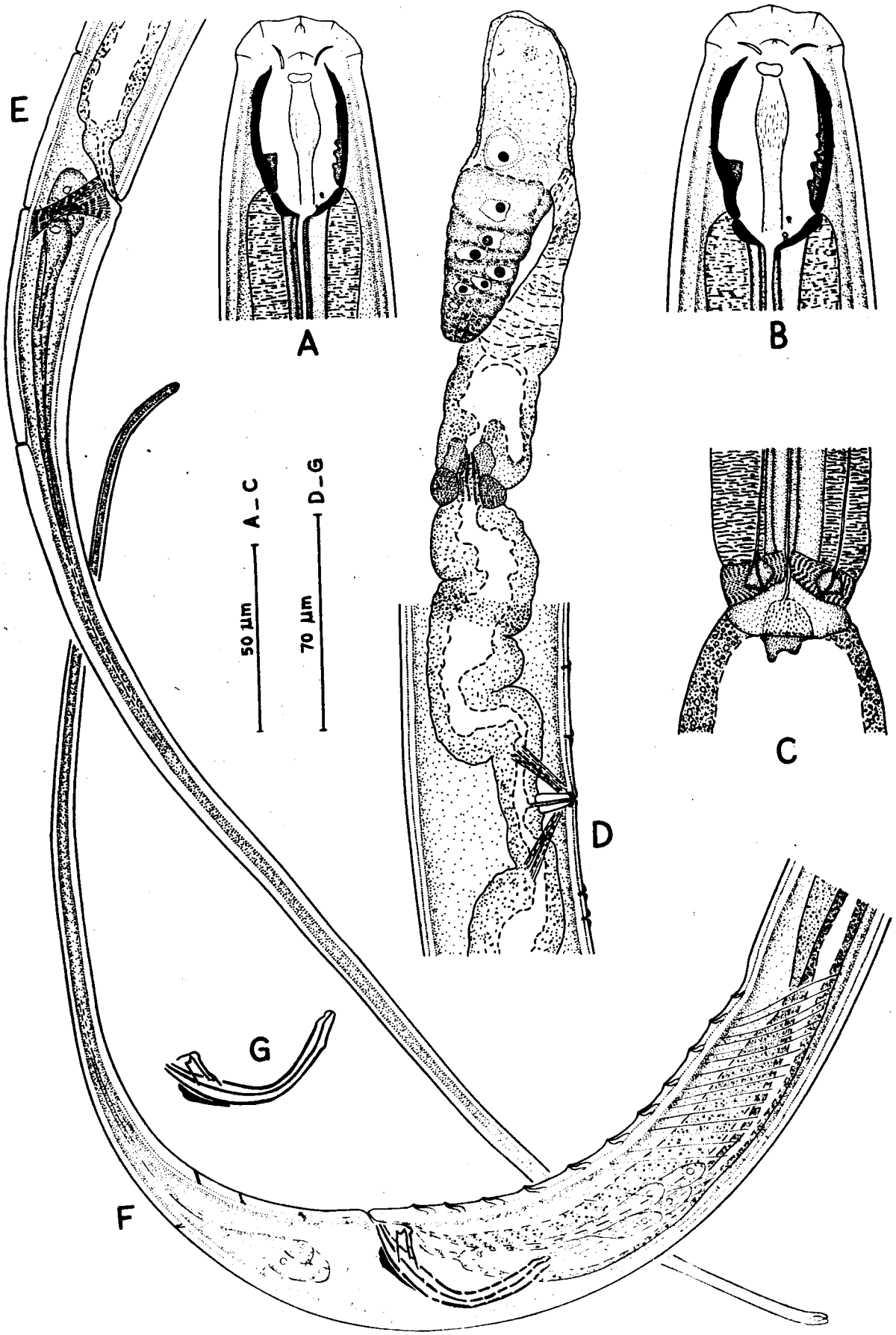

E
A
B
D
C
50 µm
A–C
70 µm
D–G
G
F

PLATE XXXV

Figs. A - E — Monanchulus nodicaudatus

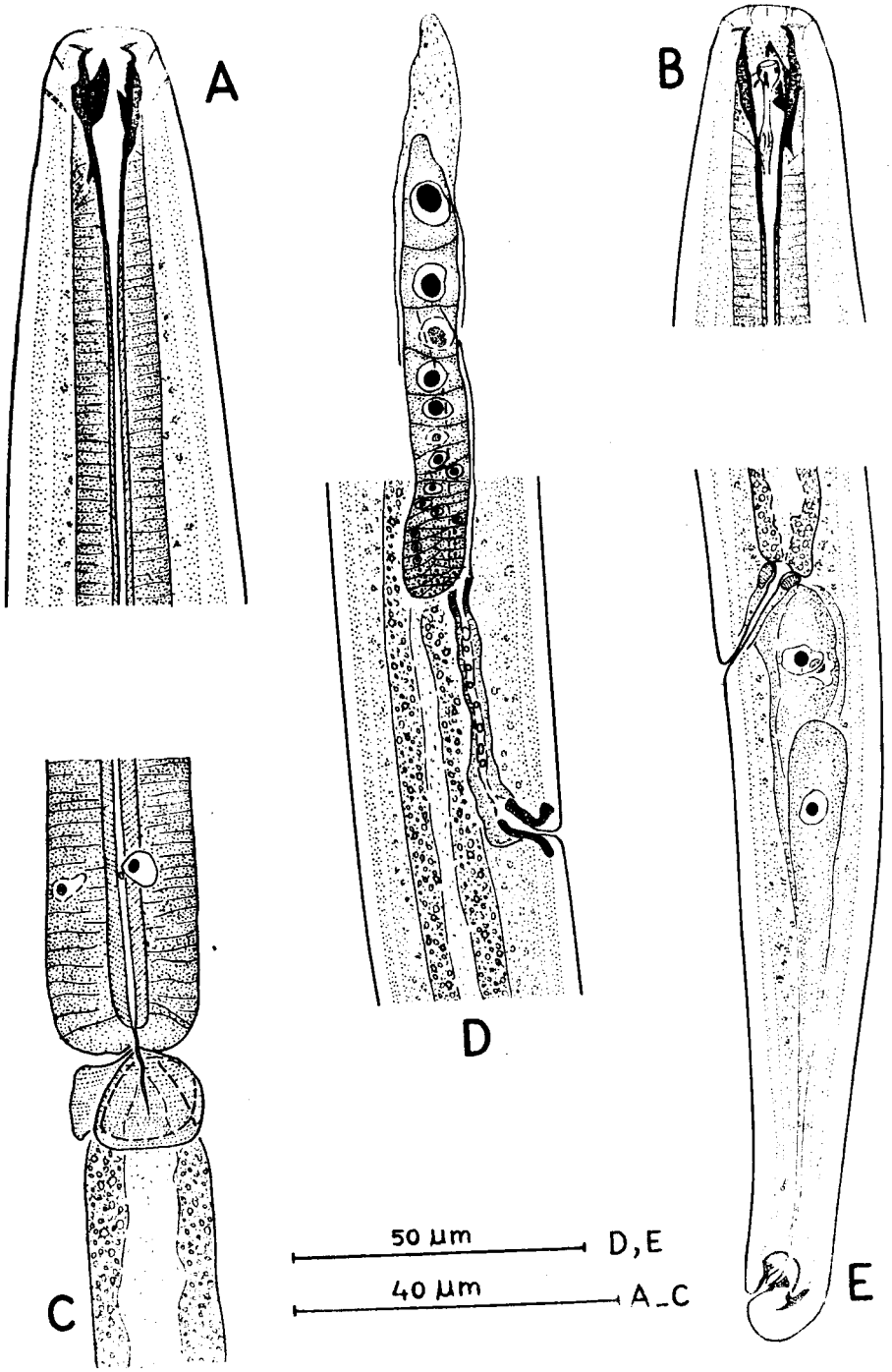
A - Anterior end (sublateral view)

B - Anterior end (lateral view)

C - Oesophago-intestinal junction

D - Anterior sexual branch

E - Posterior end.


A
B
C
D
E
50 µm
D,E
40 µm
A-C